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MOTORSHIP

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In the Interests of Commercial Motor Vessels

Vol. 2 FEBRUARY, 1917 No. 2
SEATTLE NEW YORK

LAUNCH OF AUX. MOTOR SC. "S. I. ALLARD" AT ST. HELENS, ORE., ON JANUARY 16th

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Vol. 2 Seattle, U. S. A., February, 1917. No. 2

Wooden Shipbuilding in the United States

Government Figures Show Motorship Progress

THE extent to which motor auxiliaries have come to the front as carriers is disclosed by statistics just completed by the Bureau of Navigation, Department of Commerce, which show the number of wooden merchant vessels of 500 tons gross or over building or under contract to be built in private American shipyards on January 1st, 1917, to be 161 of 207,623 gross tons according to builders returns. It is impossible to say the exact percentage of the vessels which will be fitted with motors, although the number is known to be very large. Many of the carriers are being so constructed that motors can be installed after they are afloat, this step having been made necessary by the condition of the oil engine market which has made it difficult for many owners to cover their engine requirements. Present prices and delivery terms have influenced many builders to conclude to wait until the situation is more normal before buying power plants.

The new report shows the wide extent to which Americans have re-engaged in what was thought to have become a lost art among them—the building of large wooden hulls. Incidentally the fact that this report is the product of the Department of Commerce brings to mind the fact that the Hon. William S. Redfield, secretary of this department, is credited with being the immediate father of the American auxiliary motor schooner. It is reputed that in a conference of shippers and government officials at the outbreak of the war it was suggested that in the face of the difficulty in securing materials for steel shipbuilding that the shortage of carriers be met by the construction of wooden sailing vessels of the type for which America was once famous the world over. It was then that Mr. Redfield was said to have suggested that these boats be fitted also with oil engines to increase their speed and make them less dependent upon the elements.

That the figures compiled by the bureau are very incomplete will be apparent at first glance. The New England grouping shows no wooden power vessels whatever yet the Atlantic Maritime Co., of Boston, was one of the first concerns in this country to undertake the construction of a full powered motor vessel and now has such a carrier well under way. We scan the Columbia river figures in vain for some mention of the Peninsula Shipbuilding Co., one of the largest concerns in the business, and, in fact, to be numbered among its pioneers. There is also no mention of the Olympia Shipbuilding Co., which is building three vessels for the Grays Harbor Shipbuilding Co., and while it may have been the effort of the government statistician to include these in the figures of the latter he included only one additional vessel instead of three, this alone making a shortage of approximately 5,000 tons in the Northwest returns. Omitted from the same classification is the Pacific Alaska Navigation Co., of Seattle, which has a full powered motorship completed except for the engines.

Motorship would venture the opinion that a complete canvas would make the Puget Sound-Columbia River total in excess of 100,000 or nearly half of the total shown for the entire country in the government census.

Attention is specially directed to the departments figures covering new contracts reported during December, 1916. Out of a total 33 vessels shown by the department 20 will be fitted with oil engines.

The large amount of auxiliary construction notwithstanding it is interesting to note that many of the wooden shipbuilders of the Pacific Northwest who have been building this type have concluded in the future to confine themselves to full powered vessels.

Vessels Under Construction or Contracted for at Various Yards.

The following table shows the number and tonnage of vessels under construction or contracted for in the various yards:

The geographical distribution of tonnage under construction is shown by the following table:

Geographical division.	Total construction. No.	Total construction. Gross tons.	Sail and unrigged. No.	Sail and unrigged. Gross tons.	Power. No.	Power. Gross tons.
New England	26	*a* 24,823	26	*a* 24,283	....	.....
Middle Atlantic coast	36	34,112	35	33,112	1	1,000
South Atlantic and Gulf coasts	35	*a* 41,450	13	*a* 8,170	22	33,280
Puget Sound and Columbia River	52	*a* 88,200	2	*a* 2,300	50	85,900
California coast	12	19,038	3	2,500	10	16,538
a Tonnage incomplete.	161	*a* 207,623	78	*a* 70,905	83	136,718

MERCHANT CONSTRUCTION, JAN. 1, 1917.

Shipyards.	Number.	Gross tons.
New England.		
Atlantic Coast Co., Thomaston, Me.	2	3,200
R. L. Bean, Camden, Me.	4	3,600
Bowker Shipyard, Phippsburg, Me.	1	550
Francis Cobb Co., Rockland, Me.	4	2,918
G. G. Deering Co., Bath, Me.	1	1,400
Capt. Geo. A. Gilchrist, Thomaston, Me.	1	1,200
Hartford & New York Transportation Co., Hartford, Conn	1	551
Kelly-Spear Co., Bath, Me.	3	5,154
L. L. Snow & Co., Rockland, Me.	1	700
Read Bros., Fall River, Mass.	2	2,200
Richard T. Green Co., Chelsea, Mass.	2	2,400
Robert Palmer & Sons Shipbuilding & Marine Ry. Co., Noank, Conn.	3	(*a*)
Townsend Marine Ry. & Construction Co., Boothbay Harbor, Me.	1	950
Middle Atlantic Coast.		
American Car & Foundry Co., Wilmington, Del.	9	8,692
Chas. L. Rohde & Sons Co., Baltimore, Md.	2	1,200
Coastwise Shipbuilding Co., Baltimore, Mr.	10	8,720
M. Mitchell Davis & Son, Solomons, Md.	8	10,500
Sharptown Marine Ry. Co., Sharptown, Md.	1	750
Southern Transportation Co., Chesapeake City, Md.	1	650
E. Jas. Tull, Pocomoke City, Md.	5	2,260
South Atlantic and Gulf Coasts.		
Brunswick Marine Construction Corporation, Brunswick, Ga.	5	9,550
Brunswick Shipbuilding Co., Brunswick, Ga.	1	725
Clooney Construction & Towing Co., Westlake, La.	9	6,045
Hillyer-Spearing-Dunn Co., Jacksonville, Fla.	1	780
Howland & Nelson, Beaumont, Tex.	2	1,400
Henry Piaggio, Orange, Tex.	5	*b* 8,400
Savannah Engineering & Construction Co., Savannah, Ga.	3	3,000
Slidell Shipbuilding Co., Slidell, La.	7	7,550
Wilmington Iron Works, Wilmington, N. C.	2	4,000
Puget Sound and Columbia River.		
Aberdeen Shipbuilding Co., Aberdeen, Wash.	5	8,100
Columbia Engineering Works, Portland, Ore.	5	4,950
Grays Harbor Shipbuilding Co., Aberdeen, Wash.	6	15,000
Kruse & Banks, Northbend, Ore.	5	7,500
McAteer Shipbuilding Co., Seattle, Wash.	1	(*a*)
McEachern Ship Co., Astoria, Ore.	8	13,800
Mathews Shipbuilding Co., Hoquiam, Wash.	2	3,600
Pacific-American Fisheries Co., South Bellingham, Wash.	4	9,000
Puget Sound Bridge & Dredge Co., Seattle, Wash.	4	10,000
St. Helens Shipbuilding Co., St. Helens, Ore.	5	7,200
Seaborn Shipbuilding Co., Tacoma, Wash.	4	4,800
Standifer-Clarkson Co., North Portland, Ore.	2	3,000
Winslow Marine Ry. & Shipbuilding Co., Winslow, Wash.	1	1,250
California Coast.		
Benicia Shipyards, Benicia, Cal.	2	2,500
Chas. E. Fulton, San Pedro, Cal.	2	3,600
Hammond Lumber Co., Eureka, Cal.	3	2,838
Hanlon Dry Dock & Shipbuilding Co., Oakland, Cal.	1	3,500
Jas. Robertson, Benicia, Cal.	2	3,000
W. F. Stove, Oakland, Cal.	2	3,600

a Not stated. *b* Tonnage incomplete.

Details of New Contracts.

Following are the details of the new contracts for the construction of wooden vessels of 500 gross tons or over reported to the Bureau of Navigation during December, 1916. The letters "C" and "F," representing coasting and foreign trade, respectively, have been inserted in the column headed "Trade" when the bureau's information covers that point, as well as the particular cargo for which the vessels are intended:

Name of builder's number	Gross tonnage.	Description.	Owner.	Trade.	Probable date of launch.
R. L. Bean:					
——	600	4 m sch.	F. H. Tinker		Mar. —, 1917
——	1,800	....do	Gilmartin & Trundy		June —, 1917
——	600	....do	J. M. Phillips		July —, 1917
——	600	....do	C. H. Barnes		Sept. —, 1917
Kelly-Spear Co.:					
No. 193	1,950	4 m. sch. bgs.	Not given	C.	Sept. —, 1917
Read Bros. Co.:					
Luther Little	1,100	4 m sch.	Rogers & Webb	C. & F.	Apr. —, 1917
No. 2	1,100	....do	....do	...do	No.. —, 1917
E. Jas. Tull:					
No. 44.	500	Unrigged	Diamond "P" Boat Line (Inc.).	C.	1917 delivery
No. 45	500	....do	....do	...do	Do.
No. 46	500	....do	....do	...do	Do.
No. 47	500	....do	....do	...do	Do.
Howland & Nelson:					
No. 2	800	4 m sch.	Orange Maritime Corporation.	Lumber	Aug. —, 1917
Aberdeen Shipbuilding Co					
Phyllis	1,200	3 m. aux, sch	Byxbee & Clark	...do	Jan. 15, 1917
No. 5	2,300	5 m. sch.	For Norwegian account	F.	July —, 1917
No. 6	1,800	Ga. s.	W. R. Grace & Co.	Lumber	May 1, 1917
No. 7	1,800	....do	....do	...do	Aug 1, 1917
No. 8	1,000	4 m. aux. sch.	French-American S. S. Co.	...do	June 1, 1917
Columbia Engineering Works:					
Warren P. Brown	700	....do	M. T. Snyder	Ore	Feb. 1, 1917
No. 2	825	....do	....do	...do	Apr. 1, 1917
John X. Mears	1,600	5 m. aux, sch.	M. C. Keith	...do	June 1, 1917
No. 4	825	4 m. aux. sch.	M. T. Snyder	Fruit	July 1, 1917
No. 5	1,000	....do	....do	...do	Aug. 1, 1917
Pacific-American Fisheries Co.:					
Redwood	2,000	2 m. aux. sch.	Builder's account		Jan. —, 1917
Firwood	2,000	....do	....do		Mar. —, 1917
No. 33	2,500	....do	....do		1917 delivery
No. 34	2,500	3 m. aux. sch.	....do		Do.
Standifer-Clarkson Co.:					
No. 1	1,200	4 m sch.	Libby, McNeill & Libby	Cannery	Apr. —, 1917
No. 2	1,800	Ga. s.	I. T. Williams & Son		
Hammond Lumber Co.:					
Flavel	946	3 m. aux. sch.	Builder's account	Lumber	Mar. —, 1917
Trinidad	946	...do	....do	...do	July —, 1917
No. 9	946	...do	....do	...do	Dec. —, 1917
Jas. Robertson:					
No. 3	1,500	4 m. aux. sch.	Standard Oil Co.	F.	Apr. 1, 1917
No. 4	1,500	...do	....do	...do	June 1, 1917
Total (33 vessels)	41,438				

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Sloan Shipyards Corporation Formed to Build Motorships

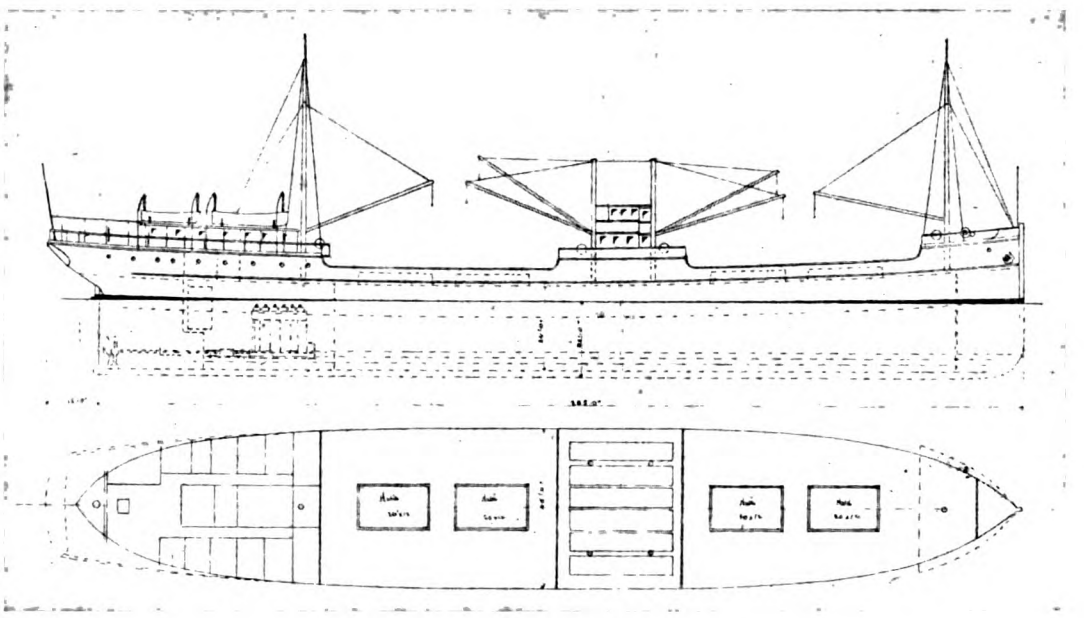
ANNOUNCEMENT has been made that the Sloan Shipyards Corporation of Seattle, at present known as the Seattle Drydock company, has leased a site at Olympia, Wash., and will immediately begin the construction of eight full powered ocean going motorships.

Philip D. Sloan, who until a few years ago was engaged in the shipbuilding business on Puget Sound, recently arrived in Seattle from New York to complete the final arrangements for putting the new plan into effect.

In a statement made to Motorship Mr. Sloan said: "The Sloan Shipyards Corporation will be the new name of the Seattle Drydock company, which was incorporated by me on March 14, 1911, the change being made because of the fact that a similar name has since been adopted by another Seattle concern. The officers of the new corporation will be Philip D. Sloan, president; John O. Pierce, formerly secretary and treasurer of the Brookes Manufacturing Co., the well known manufacturers of knocked down boats, of Saginaw, Mich., secretary and treasurer; other officers and directors to be named later.

"This company has been incorporated with a capitalization of $1,000,000 with 400,000 in preferred shares and the balance in common stock. Only a small amount of the preferred stock has been issued.

"Offices have been opened in the Colman Bldg., Seattle, with Joseph A. Sloan associated with us in a consulting capacity while our building will be carried on at Olympia where a site five city blocks in extent has been leased. Our site has a frontage of 700 feet and an area of 12 acres, it adjoins a plot now being used for similar purposes. We will have O.-W. R. & N. trackage with three switches. It is interesting to note that the public spirited citizens of Olympia have subscribed $25,000 to induce this concern to locate there, it being our original intention to locate at Seattle. Our site has been leased for five years with a privilege of renewal for 15 years.



GENERAL PLANS OF SLOAN MOTORSHIPS.

"Piles are now being driven and when the work is completed we will immediately plank the berths over and start work. The frames will be handled by the gantry crane method as devised by Joseph Sloan. The yard will have three gantry cranes, one between each pair of hulls. We are installing a Fay & Egan and two American band saws.

"We will construct eight full powered motorships. Each to be 280 feet over all with a beam of 46 feet outside the planking and of 24 feet moulded depth. The vessels will be of about 3,200 tons deadweight, beamed for 'tween decks, but without them. They will be general carriers, having a yacht stern and designed for off shore tramping. Each vessel will be fitted with two 500 b. h. p. 6-cylinder 4-cycle McIntosh & Seymour Diesel type oil engines, giving a total of 1,300 i. h. p. to the hull. Eight engines have already been ordered from the makers and the first engines are now under construction at Auburn, N. Y. Delivery of the engines begin June 1st, and from then on we will get a set every month or two weeks as provided in our contracts. We expect that these boats will develop about 10 miles. Auxiliary equipment will be steam driven.

"Keels for the first vessels will be laid about March 1st, and while we are making no definite statements about launching we will do everything in our power to expedite construction through the employment of thoroughly modern methods."

SHELL TOWING ON THE MISSISSIPPI WITH A MOTOR VESSEL.

Among the last boats on the Mississippi in the fall and the first in the spring are the boats of the clam shell buyers who purchase mussel shell of the clam diggers and sell them to the button factories. Since the decline of rafting on the Upper Mississippi the amount of tonnage per annum carried by the clam shell boats exceeds that of any other commodity freighted on the river.

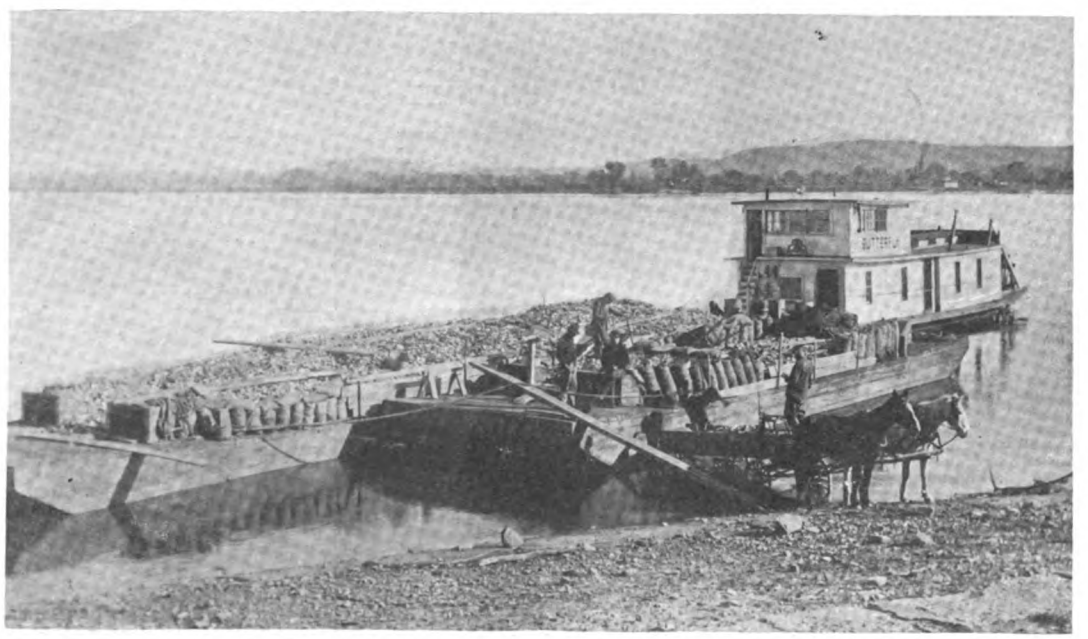
The "Butterfly" is one of the most familiar of the shell boats. It belongs to Henry Kath, of Muscatine, "the shell man," as he is known all over the Upper Mississippi Valley. Mr. Kath is a resident of Muscatine, Iowa, the largest pearl button manufacturing center in the world. He has been in the shell business since the commercial value of the mussels of the Mississippi and its tributaries was first exploited twenty years ago. He is the largest independent buyer in the country and knows more about the clam business probably than any other man on the Mississippi. He has four boats and buys shells on the Ohio, Cumberland, Tennessee, White, Arkansas, Rock, Illinois, Cedar, Iowa and a dozen smaller rivers besides the Mississippi. The four boats run from about the middle of May until well along in November. Each tows two barges holding about a hundred tons of shells each. The Butterfly is kept exclusively on the Mississippi. The other boats, the "Nigger Head," "Mucket," and "Blue Point" are on the tributary streams most of the time.

The "Butterfly's" engines are two cylinder of the Titan type, made by the International Harvester Co., and are rated as a 50 h. p. engine. Mr. Kath, who is very proud of his power plant, says these engines developed 63 h. p. in the factory before they were installed. She is equipped with air tanks for starting, and mounts a small air compressor which keeps them charged.

When Mr. Kath began the shell business he paid $4.50 a ton for nigger heads, the thick black clam shells which are among the best for buttons. He is now paying $40 for them or more than nine times as much. The yellow backed sand shells are selling even higher. The poorer shells such as muckets buy at an average of $20. The two barges of the "Butterfly" when loaded to capacity carry a cargo worth $4,000 to $6,000. The nigger heads and sand shells are sacked by the clammers and sold in that way, the shells running from 25 to 50 pounds to the sack.

Some of them are shipped to Canada and Eastern cities in the United States, especially Newark, New Jersey. But the very large part of them, previous to the war, were sent to Europe. Hamburg and Havre are chief purchasing points. American manufacturers, Mr. Rath says, claim they cannot afford to make buttons out of the high priced shells. In the accompanying picture several hundred of these sacks of nigger heads and sand sells are loaded on the barges. The cheaper shells are shoveled loose onto the barges.

Though shells are scarcer because of the enormous raids on the clam beds which the fishermen have made the last few years, the better prices are maintaining the business at a high point and Mr. Kath believes it will continue to be a very profitable tow business. Eighteen years ago there was not a fresh water pearl button factory in the United States. Now there are hundreds of them operating the year round not only in Mississippi river towns and cities but all through the manufacturing centers in the East. Besides making buttons from the shells, many of the manufacturers are fashioning cuff links, shirt studs, barrettes and other fancy articles out of them.



MOTOR CLAM SHELL CARRIER "BUTTERFLY."

LONG NON-STOP RUN.

The Glen Line motorship "Glengyle" recently made a non-stop run from Singapore to Suez, a distance of 4,997 miles at an average speed of 10.1 knots. The "Glengyle" is of 9,400 tons d. w. c. and is driven by two British-built Burmeister & Wain Diesel engines each of 1,475 i. h. p.

BOAT WANTED.

To charter.—For service in Southeastern Alaska, motor freighter having carrying capacity of twenty-five to fifty tons deadweight capable of making eight miles. Will charter for season 1917. Send full particulars at once to H. G., care this journal, Smith Bldg., Seattle.

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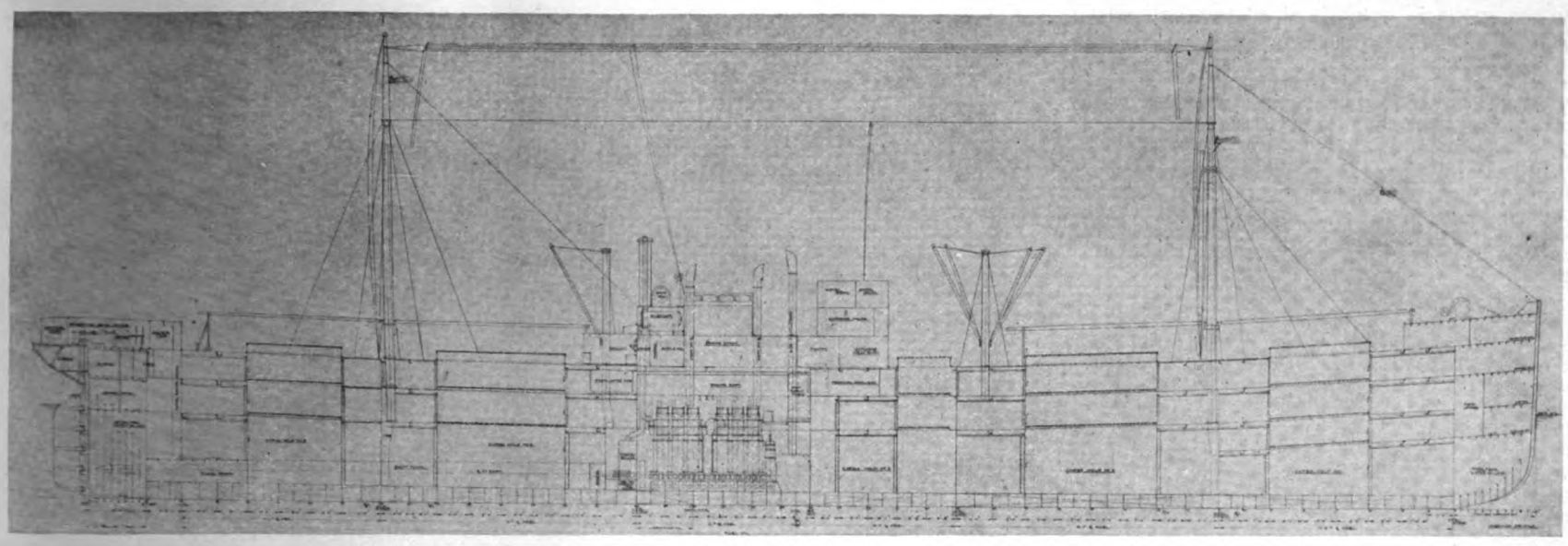
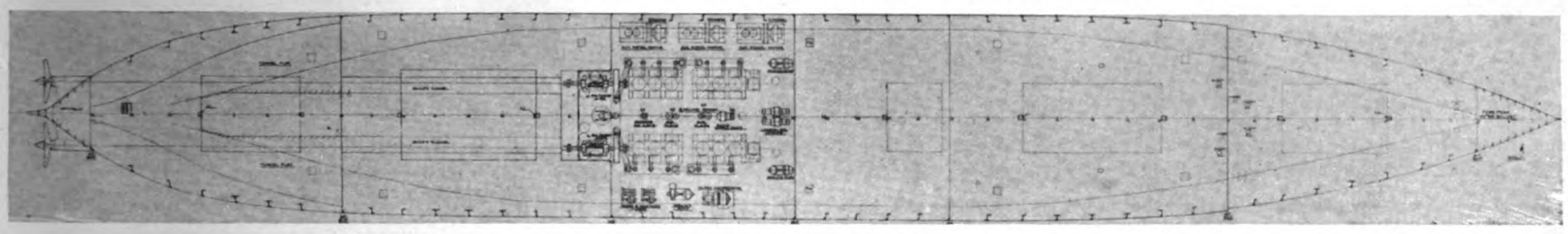


ARRANGEMENT OF MACHINERY, HOLDS AND TANKS OF 12,100 TONS DISPLACEMENT MOTORSHIP. (Fig. 1)



(Fig. 2.)

Comparison of a Motor Vessel With a Sister Steamer

By J. C. SHAW

IN the January number of Motorship the announcement was made of the commencement of the construction of a large motorship by Cramps. A description of this vessel and a comparison of it with a sister ship, but steam driven, should prove of particular interest to the ship owners of the country. Both vessels are building under the present same conditions as to labor and material, which should give the builders a fair check on the relative costs of the two systems.

The lines of the two vessels are identical with the exception at the sterns due to one being twin and one single screw. They are 420 feet long overall; 404 feet between perpendiculars; 53 feet 9 inches beam; 36 feet 9½ inches depth; and 26 feet normal draft, corresponding to 12,100 tons displacement, with a maximum displacement of 13,340 tons corresponding to 28 feet 4½ inches draft.

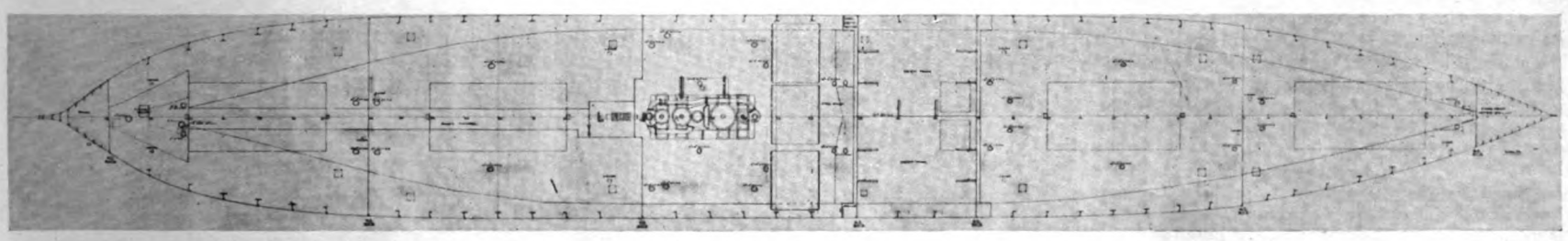
The arrangements of machinery, holds and tanks are shown in figures 1 and 2 for the motor vessel, and in figures 3 and 4 for the steam vessel.

The motorship is twin screw and is to be driven by two six-cylinder Burmeister & Wain engines, having a bore of 24 13/16 inches and stroke of 37¾ inches, and rated at 3,100 i. h. p. total running at 130 r. p. m., which is estimated to give the vessel a speed of about 11½ knots under normal load conditions. The steam vessel is single screw and is to be driven by a quadruple expansion engine having cylinders 25½ inches, 37 inches, 52½ inches, and 76 inches by 54 inches stroke, and rated at 3,000 i. h. p. at 75 r. p. m.

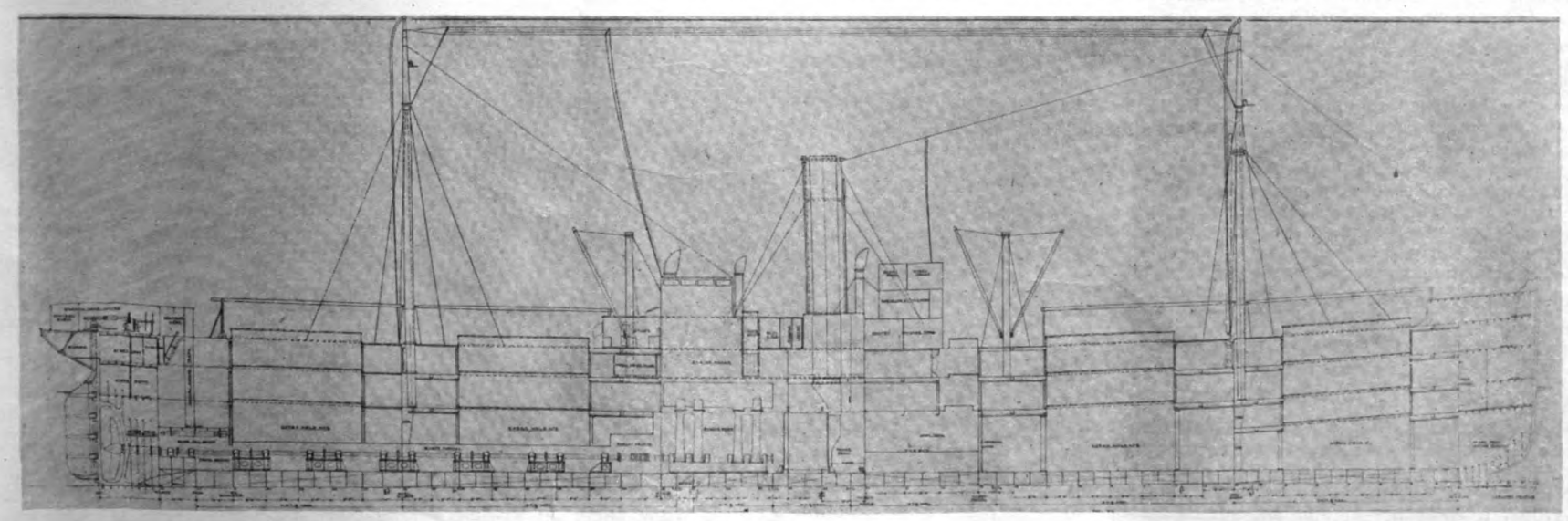
Although the mechanical efficiency is higher for the steam engine, it is expected that the i. h. p. required for either vessel will be very little different at equal speeds and displacements. This is based on some experiments conducted on two sister ships some years ago by the Copenhagen firm, and is explained partly by the much better immersion of the small screws under the average service conditions.

All auxiliary machinery, including steering gear and deck machinery, for the Diesel boat will be electrically driven, and for the steam vessel the usual steam drive.

The saving in weight of propelling machinery of Diesel installation is 130 tons over that of the steam plant. The hull and machinery weight for the motor vessel is 3,752 tons against 3,870 tons for the steam vessel. The increase in weight due



ARRANGEMENT OF MACHINERY, HOLDS AND TANKS OF 12,100 TONS DISPLACEMENT OIL BURNING STEAMSHIP. (Fig. 3.)



(Fig. 4.)

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to the spectacle frame is about compensated for by reductions in weights elsewhere.

It will be seen that the engine room space occupied for the motor installation is 48 feet 6 inches, and is 20 feet 6 inches less than that of the steam plant, which includes a 32 feet deep tank used exclusively for either oil or coal.

The Diesel boat carries all its fuel oil in the inner bottom, which filled is 1,100 tons, sufficient for about 30,000 miles. The steam vessel can carry 920 tons in the inner bottom and 740 tons in the deep tank, making 1,660 tons total maximum.

Compared on cargo hold capacity the Diesel vessel has 453,400 cubic feet available as compared with 420,300 cubic feet for the steam. Exclusive of the saving in fuel, this represents about 8 per cent. more cubic capacity for the first vessel or earning capacity where the freight is a bulky nature.

From results of Burmeister & Wain plants of this size the oil consumption is about .30 pounds per i. h. p. main engines for all purposes when at sea. From previous vessels in service the quadruple will require about .95 pounds of oil per i. h. p. main engine for all purposes. Per day basis the consumptions figure out accordingly at 10 and 31.5 tons respectively. In port the Diesel will consume a little less than a half ton a day and the steam vessel not less than five tons.

To compare the cargo carrying capacities of the two vessels a specific example is taken here of a round voyage from New York to Buenos Aires and return, which is approximately 6,000 miles one way. A speed of 11.5 knots is assumed and a limit of draft of 26 feet on leaving either port. Also a stay of ten days is assumed at the southern port and sufficient oil is left on hand on returning to New York for three days steaming for each vessel. The comparison is then about as follows:

	Diesel	Steam
Hull and machinery weights (tons)	3,752	3,870
Oil on board New York leaving (tons)	470	1,515
Crew, drinking water and stores	60	60
Cargo taken on at New York (tons)	7,818	6,655
Displacement leaving New York (tons)	12,100	12,100
Oil burned trip down (tons)	218	685
Oil burned in port (tons)	4	50
Oil on board leaving Buenos Aires (tons)	248	780
Cargo taken on at Buenos Aires (tons)	8,040	7,390
Oil on board arriving New York (tons)	30	95
Total cargo carried round trip (tons)	15,858	14,045

From above it is seen that the motor vessel would be able to take about 17 per cent. more freight on the trip going and nearly 9 per cent. more on the trip returning, or 13 per cent. more for the round voyage. Assuming the motorship used a 5 cent oil of 24° Be′ and the steam vessel a 4 cent oil of 18° Be′, the net saving of the Diesel in fuel for the round trip would be about ten thousand dollars. This is offset slightly by the greater consumption of lubricating oil of the Diesel over the steam amounting to about 350 gallons difference for the voyage, the Diesel taking about 800 gallons and the steam about 450 gallons for the round trip.

As to the cost in operating the two vessels from a personnel standpoint the difference would be practically nil, there being required nearly the same number of engineering force in either case due to the steam vessel being single screw and oil burning.

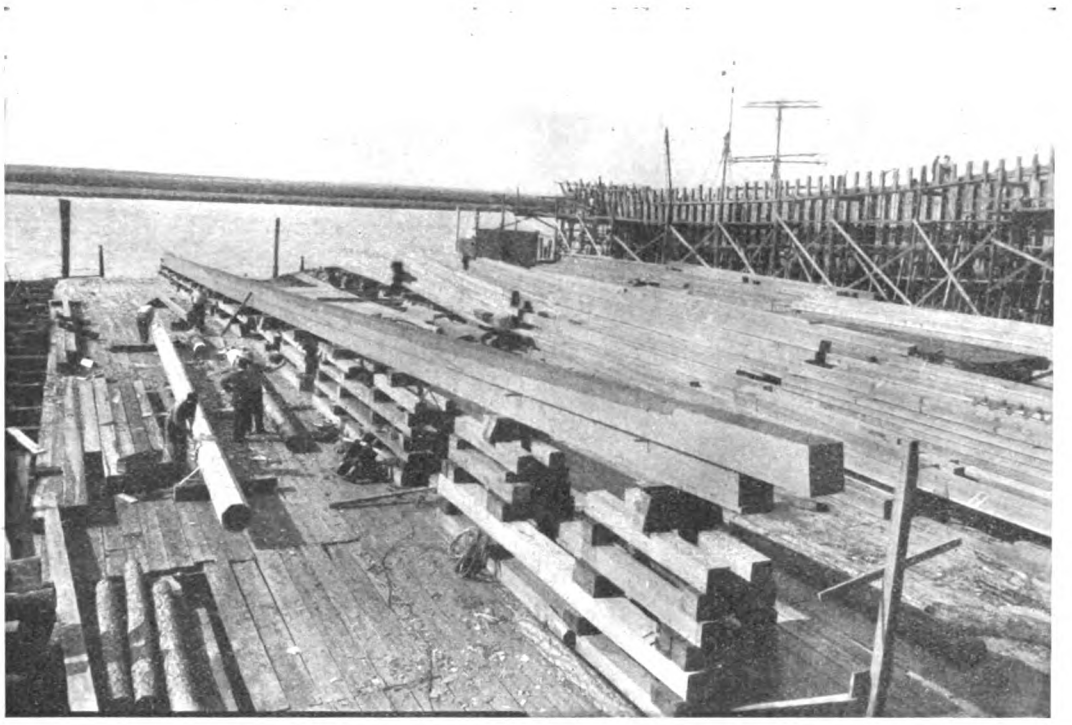
From the foregoing the motor boat is seen to have a decided advantage over the steam vessel, especially where the voyages are long, and should show a handsome return on the capital invested when the steamer is actually operating at a loss to the owners.

SMALL MARINE DIESEL ENGINES.

The A. B. Diesels Motorer Co., of Stockholm, Sweden, manufacturers of the Polar Diesel marine engines, and under whose license the McIntosh & Seymour Corp., of Auburn, New York, are working, has standardized a series of small marine Diesel engines. These little motors are, of course, non-reversible, so are very simple in construction, reversing being carried out by means of a mechanical reversing gear. The standard of sizes are 37½ b. h. p., 50 b. h. p., 75 b. h. p., and 100 b. h. p., all developing their power at 550 r. p. m.

STANDARD OIL COMPANY'S MOTORSHIPS.

The motorship fleet of the Standard Oil Co., and its connections, now consists of the following vessels, viz: "The Hagen"; "Loki"; "Wotan"; "Rose Mahony"; "Andrew Mahony"; "Bequoit"; 'Quevilly", a large barge, and six auxiliaries of the "Starlite" class, or 14 craft all told. They have, of course, numbers of small motor craft in addition.



LAYING KEELS FOR MOTOR AUXILIARIES AT BRUNSWICK, GA.

DESIRES AGENCIES.

We know of an English gentleman of responsibility, who has strong interests in the commercial and pleasure motor-boat industry, who is anxious to obtain really good agencies from American manufacturers of marine motor-boats and accessories. He can do a big business in Russia, and is working with Russian people on the spot. The gentleman in question is personally known to ourselves, and any manufacturers who care to write direct to us will be furnished with his name and address.

VOYAGE OF THE "BRAMELL POINT."

The motorship "Bramell Point" arrived in New York on the Dec. 25th from Lisbon, Portugal, and we understand that her owners, the Vacuum Oil Company, have expressed great satisfaction in regard to the efficient running of her oil engines. This is gratifying news because some shipowners expressed fears that the power of the engines was too great for machinery of the surface-ignition type, and once again illustrates that practice disproves theory. The trials of the "Bramell Point" were described at length in the December issue of Motorship, an exclusive account being given.

SPARE PARTS ON MOTORSHIPS.

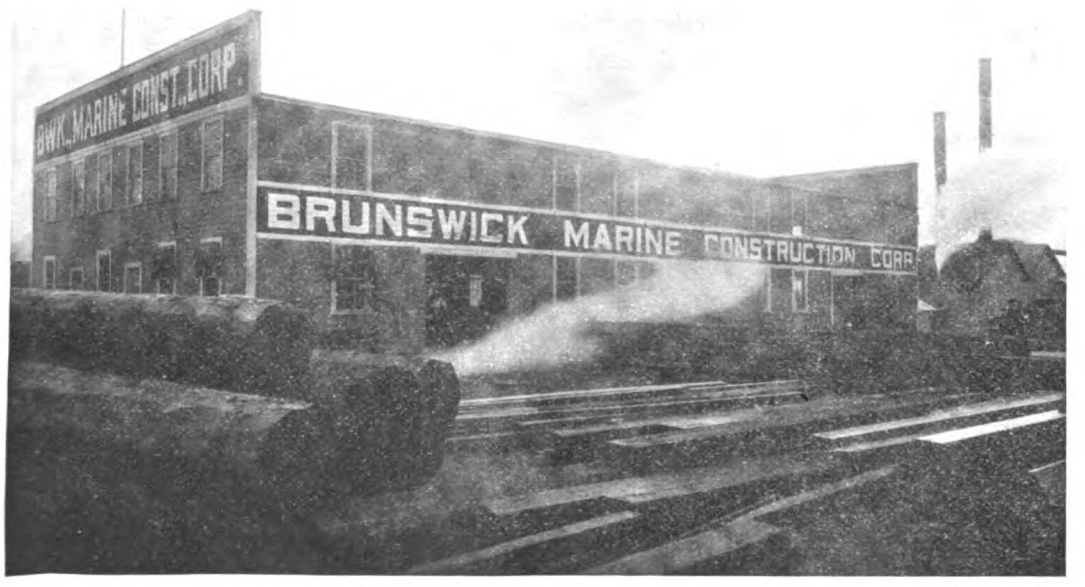
A well-known ship owner recently stated that some time ago he inspected a well-known German-owned motorship and he took particular notice that a great number of spare parts were carried. Consequently he received the impression that these were considered necessary by the owners. Unfortunately he omitted to inquire to see if many of the spare parts had actually been used. The real reason of the large number of spare parts being carried was, that, it was done according to the German Lloyd's rules, and there were not any more than would be carried on a German steamer of the same size and power.

BRITISH SHIPS SUNK IN THE WAR.

In the twenty-seven months of war from August, 1914, to October, 1916, 433 British steam vessels of more than 1,600 tons, representing 1,744,000 tons gross register, were lost through war perils. Great Britain started the war with 3,600 steamships, of 16,000,000 tons gross, so that the losses represent 12 per cent in numbers, or 11 per cent in tonnage.

BRITISH NAVAL DIESEL TANKERS.

"Trefoil" and "Turmoil" are the names of two of the Diesel motor-driven oil-carrying vessels owned by the British Admiralty.



GENERAL VIEW SHOP, BRUNSWICK MARINE CONS. CO.

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Motorship Construction in the South

Development of the Brunswick Marine Construction Co.

THE past twelve months have seen some most unexpected developments in the shipbuilding world, and the demand for tonnage, in conjunction with the difficulty steel plate mills have in coping with the market, has enabled wooden shipbuilding yards to spring up like mushrooms here, there and everywhere, and the presence of suitable timber has enabled shipbuilders to commence operations in places which otherwise would have been considered out of the question.

In many ways the rejuvenation of the wooden sailing-ship has been the means of placing the marine oil engine before large ship owners in a manner that has caused them to fully appreciate the value of this system of propulsion. To some shipping concerns the oil engine has been a salvation, for by its adoption they have been furnished with reliable power-driven vessels unobtainable so quickly by other methods. We refer to the large number of auxiliary schooners recently built and now under construction.

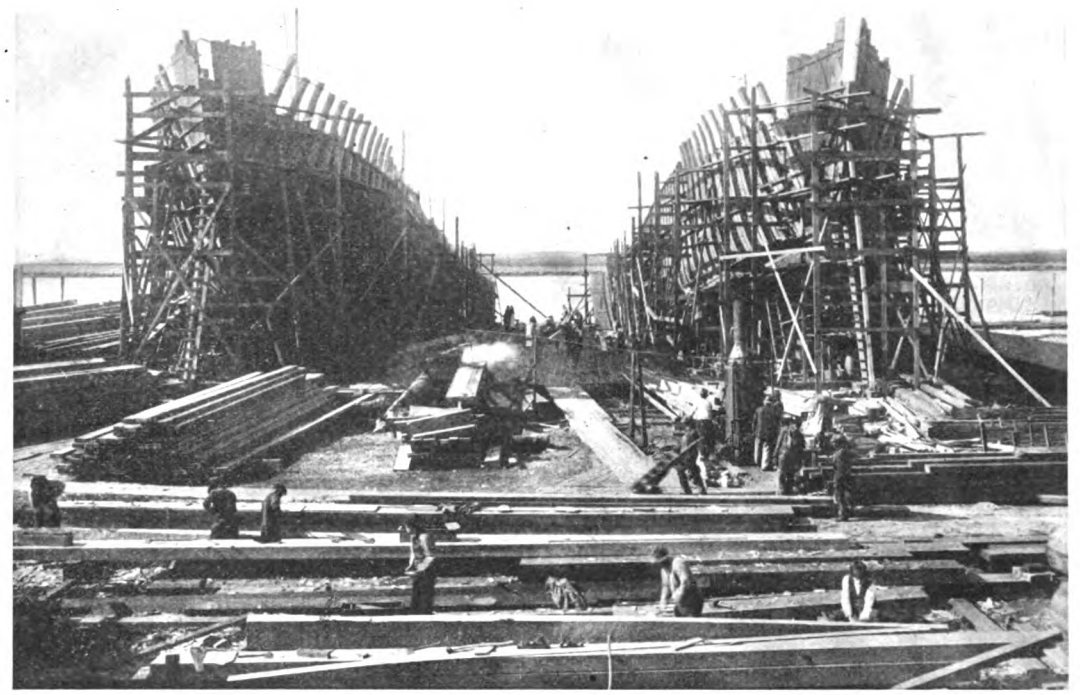
In one or two instances steam is being installed; but steam as auxiliary power, or steam in a wooden vessel, is but a very poor substitute for motor power. Auxiliary motor sailing-ships properly designed will be enabled to compete with full powered steamers when normal times are resumed; but who can imagine auxiliary steam sailing-ships of large tonnage?

A new shipyard was erected last year (1916) at Brunswick, Ga. The company is known as the Brunswick Marine Construction Co. with a yard at Bay street between Dartmouth street and Second avenue. This is a splendid site for wooden shipbuilding, being adjacent to the Trant lumber plant; and near the works of the Parker-Hensel Engineering Co., which has been absorbed by the shipyard. There is a 30-foot channel from Brunswick to the sea, and the yard is sheltered by the magnificent government breakwater.

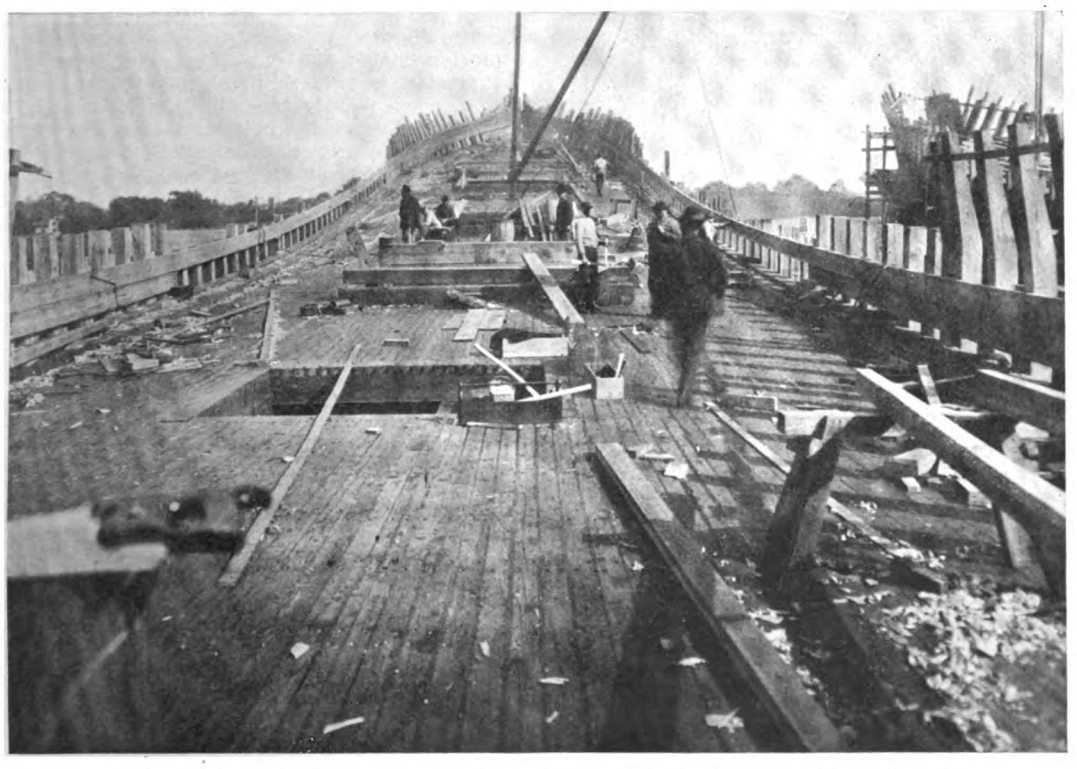
Willard U. Taylor, of New York City, is president, and R. Lawrence Smith, vice-president, and the superintendent of the plant is W. H. Rutland. Mr. Taylor is a well-known lawyer, prominent in marine circles, and once was president of the Maritime Exchange. He also is a prominent yachtsman, and is Commodore of the Atlantic Yacht Club.

Quite a moderate capital was raised, this being $100,000, divided into 500 perferred shares of $100 par value, and the remainder common stock. The first sod was turned by Mr. Taylor on April 26th last, and the first launchway was completed the following month. In June the keels of two motor auxiliaries were laid. Offices, a planing mill, a restaurant, and a building shop have been erected, and everything now is in full swing, about 500 men being employed. The building shop is 110 feet by 50 feet and is two stories high, the second floor being used as a moulding room and sail loft. As regards the Parker-Hensel plant; this consists of a machine shop, iron foundry, boiler shop and marine railway. Later on it is the intention of the company to build steel ships and very possibly marine oil engines. Building steel ships here seems practical for the freight rate from the Birmington district is only 14 cents per 100 pounds, compared with 15.9 cents from Birmingham to Philadelphia, or 21.3 cents from Birmingham to Newport News. From Pittsburg the rate is 24 cents.

Altogether five wooden schooners have been laid down at the Brunswick yard, two being auxiliaries for a well-known New York company. These vessels have been designed by Cox & Stevens and are four-masted schooners, each 205 ft. overall, by 39 ft. beam; 12 ft. depth of hold, and 12 ft. mean draught. On a maximum draught of 14 ft. 6 in. they will have a dead-weight capacity of 1,300 tons, the gross tonnage being 650 tons. For auxiliary propulsion each will be fitted with two four-cylinder, 14″ by 18″ Mietz surface-ignition oil engines of 150 b. h. p. It is intended to launch them in April or May next.



FROM A PHOTOGRAPH MADE JAN. 12, 1917, AT BRUNSWICK, GA.



DECK OF ONE OF THE AUXILIARY SCHOONERS BUILDING AT BRUNSWICK, GA.

The other three vessels are for the Apex Navigation Co., of New York, another firm with which W. U. Taylor is associated, and are four-masted schooners from the drawing boards of the same designers. They are rather larger craft, being 223 ft. long overall by 14 ft. 8 in. by 19 ft. 10 in. depth of hold, and have a d. w. c. of 2,000 tons.

It was originally intended to equip these three ships with auxiliary motor power, but the present high price of oil engines, and the high cost of fittings pertaining to the installations, together with rather long deliveries for engines caused the owners to decide to launch them without power and make them full rigged ships.

We cannot help believing that the owners are making a vital mistake, for, to an extent these ships are being built as a speculation, and the market for sailing ships is not nearly so good as the market for motor auxiliaries, and the latter can command a much greater price. In fact the difference in the price should be sufficient to buy several sets of high-powered oil engines.

Close to the yard just described is the Brunswick Shipbuilding company which has been formed for the purpose of building a 600 ton motor auxiliary sailing ship for Capt. John H. Leo, with own capital. This vessel has been named "Alpha" and soon will be launched. When she has been sold another will be laid down.

CONVERTING STEAMERS TO DIESEL MOTOR POWER.

Among large steamships that have been converted to Diesel-oil engine power may be mentioned the "Robert-Nobel," "Bandon," "Chumpon," "Hebe," "Jakut," "Gestrikland." The m. s "Chumpon" increased her cargo carrying capacity by 800 tons, or over 12%, and reduced her fuel consumption from 36 tons per day to 8 tons per day including auxiliaries. Query, does it pay to convert steamers to Diesel-engined power?

FRENCH-BUILT MOTORSHIP VISITS PHILADELPHIA.

Among recent visiting ships to Philadelphia, Pa., was the French motorship "Motracine," a tanker owned by the Societe Naphthes Transports. She is of 5,200 gross tons register, and is equipped with two Werkspoor-type Diesel engines of 850 b. h. p. each, which were constructed under license by the Chantiers de St. Nazaire, who also built the hull. Her length is 350 ft. by 46 ft. beam and 22½ ft. draught.

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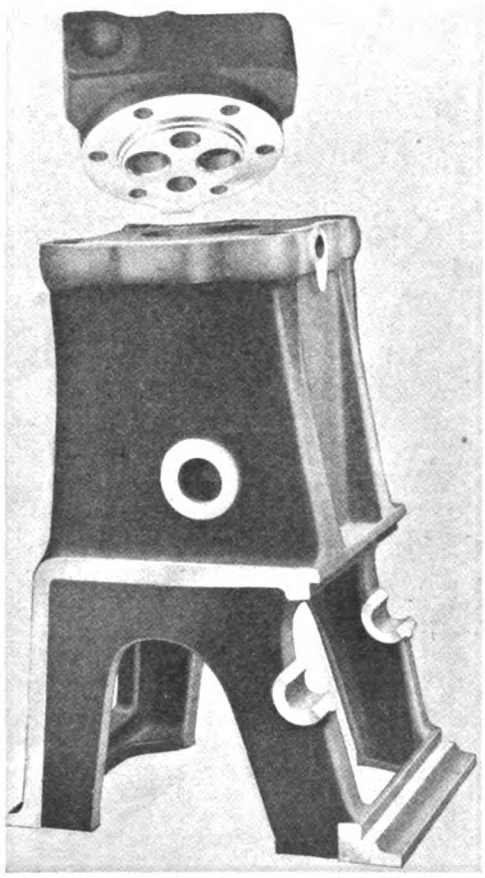
A True Semi-Diesel Motor

Details of a Marine Motor of Peculiar Interest

EXTREMELY few of the surface-ignition oil engines termed "semi-Diesel" motors are actually of that class, most of them being hot-bulb engines, pure and simple. But the outfit that we are about to describe in this article may properly be designated "semi-Diesel" engine, for its operation more closely resembles the Diesel cycle than that of any other design; yet it is by no means a Diesel engine nor is it a hot-bulb motor. Also the term "surface-ignition-engine" is applicable to it. What



CYLINDER HEAD AND CYLINDER BURNOIL ENGINE.—NOTE VALVE ARRANGEMENT IN FORMER AND SQUARE CONSTRUCTION OF LATTER

seems most extraordinary is that its builders do not claim it as a "semi-Diesel," but simply term it an "oil engine," apparently being content to let it enter the market on its own merits, thereby intentionally or unintentionally—We know not which—creating in a dignified manner what may result in a tremendous advertisement. If intentionally, it certainly denotes considerable cleverness and a knowledge of human nature on the part of its producers; for, by offering it as an "oil engine" the public has to make close investigation in order to discover what kind of oil engine it is, and all of us are more or less blessed with the curse of Mother Eve.

We are referring to the Burnoil engine built by the Burnoil Engine Co., of South Bend, Ind. The principle on which this engine operates was first produced in Holland by the Brons Motor Works of Appingedamm; and afterwards also was constructed by the Deutz Co., of Cologne, Germany. The Burnoil Co., we believe, have the sole American rights. In moderate powers and on light residual oils and on kerosene this design of engine has proven itself to be very successful indeed, and almost as economical in consumption as the true Diesel type. Quite a number are installed as auxiliary power on some of the large European motorships. Also, the Burnoil Co. are building three engines, (two of 40 b. h. p. and one of 10 h. p.) for auxiliary machinery operation on a motorship now building at Seattle, in which Southwark-Harris Diesel engines will be the main propelling power.

Some time ago very thorough tests were made on three engines at the Brons Works by Professor Dyehoovn, and the following fuel consumptions were obtained:

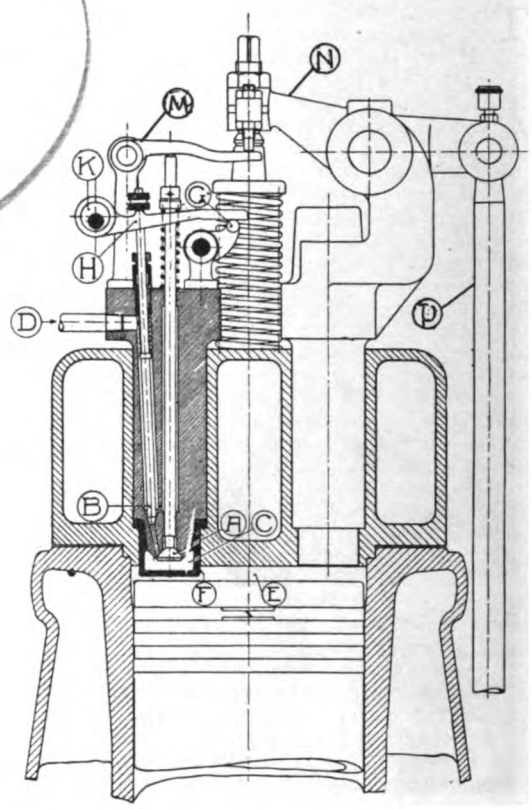
Engine.	B. H. Power.	R. P. M.	Consumption
No. 1	82	225	0.427 lbs.
No. 2	25	250	0.448 lbs.
No. 3	4	460	0.587 lbs.

As yet we have not had the pleasure of personally visiting the Burnoil works—although we have been warmly invited—but, if the makers are adopting the same conservative policy and the same standard of construction as the two European manufacturers, they have a splendid future in the commercial and pleasure marine markets. The engine is new to the American field; but its reputation is firmly established in Continental Europe. It also is built in England by J. Samuel White & Co., of Cowes, Isle of Wight, who are well-known as torpedo-boat-destroyer builders, and who have had very fine results with it. In penning the foregoing remarks we are inclined to think that some of them may surprise the Burnoil Co., our information not having come from them, so is candid and unbiased.

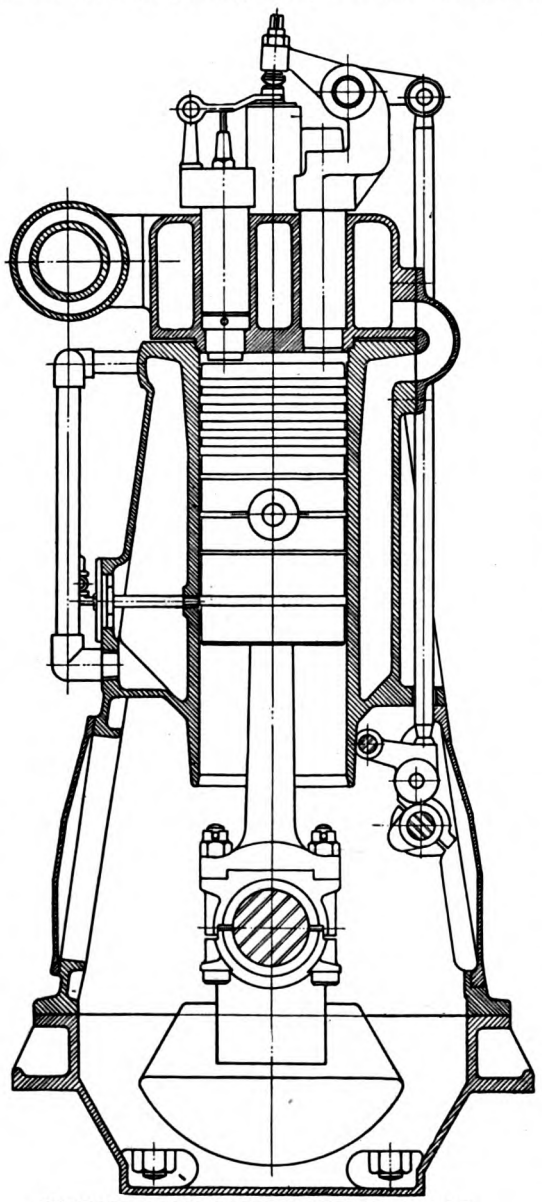
About eighteen months ago we visited a large four-year-old Diesel motorship at Chester, Pa., and the results of our visit were put into cold print. We cull from the article in question a reference to an engine of this design built at the Brons works, as follows:

"The little 7 h. p. auxiliary semi-Diesel motor was running continuously during our two-hours' stay, but we did not see one of the staff go near it, showing the implicit confidence they have in its reliability."

Having dealt at length with generalities we now will get down to techniques, and give a description of the Burnoil engines under which name it is known in America. It is of the four-cycle type, and, as with the Diesel cycle, heat for combustion is generated by compressing atmospheric air to about 450 lbs. per sq. inch; but the method of introducing the oil fuel into this heated air is quite different; and it is claimed that just as much, if not more, heat units are gotten out of the fuel by the method adopted.



SECTION COMBUSTION CHAMBER AND CYLINDER HEAD BURNOIL ENGINE SHOWING METHOD OF FUEL INJECTION, ETC.



CYLINDER CROSS SECTION BURNOIL ENGINE.

Fixed in the cylinder head and partly protruding inside the combustion chamber is a small cup or container, and oil fuel is fed by gravity into this cup (C) via the needle-valve (B) and the fuel valve (A), these valves being open on the suction stroke, the needle-valve regulating the quantity of oil.

In the walls of the cup (C) are a number of fine holes, and towards the end of the compression stroke the highly-heated air is forced through these holes, also the walls of the cup are heated, with the result that part of the fuel inside the cup is vaporized.

Just as the piston reaches the top of the stroke the temperature becomes sufficiently high to ignite the vapor formed, causing a miniature explosion inside the cup (C). The force of this explosion is greater than the cylinder compression, consequently the still fluid oil remaining is sprayed through the holes into the cylinder where the main combustion instantly occurs and the piston is driven down on its power stroke.

On the next up-stroke of the piston, the burned gases are scavenged out through the exhaust-valve, and on the following down-stroke clean atmospheric air is drawn in, the suction also drawing the fuel into the cup as before, and the previous cycle of operations is repeated. Hence, no electrical or hot-bulb ignition device is required to assist the combustion.

The question of governing is an important one. To the little lever (g) is connected a centrifugal governor, and the raising or lowering of this lever (which is regulated by the engine speed) varies the opening of the needle valve (b), the point of contact being on the intermediate lever at (h), so that when the engine is running unattended, the amount of fuel entering the cup is automatically controlled. One end of the intermediate lever (h) is eccentrically mounted at (k) for the purpose of hand regulation of fuel, as this eccentric can be turned by hand lowering or raising the needle valve. At the same time this eccentric does not cut the governor out of action, hence at no period can the engine race.

The fuel-valve and the needle-valve are operated by means of the depression lever (m) the latter being actuated by the rocker (n) which in turn is worked by the push-rod (p), that is lifted by a cam on the camshaft. The inlet and exhaust valves also are operated by rockers and pushrods.

It will be noticed that the fuel-valve is placed to one side of the cylinder head, and not in the center, which arrangement allows of good cooling-water space between the exhaust-valve and the fuel-valve. For starting purposes there is an air-compressor at the forward end of the engine, and this charges a reservoir tank to about 300 lbs. per sq. inch.

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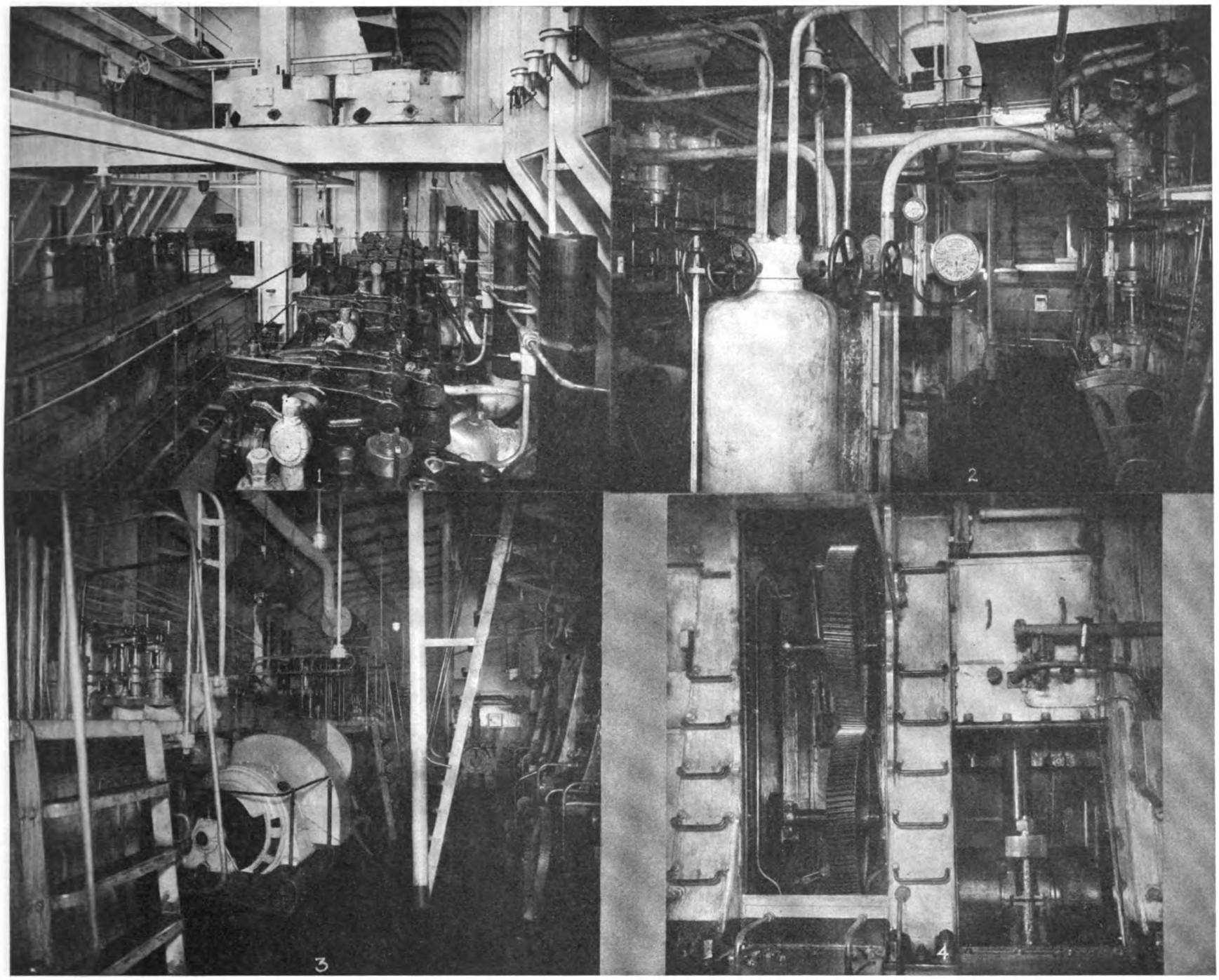

INTERIOR VIEWS OF MOTORSHIP CHILE.

1. View of cylinder heads looking forward from after part of starboard engine, showing valve arrangement. 2. View between engines looking aft along engine room floor. Control mechanism at right. 3. Aux. generator engine on port side. Rear of port main engine at right. Valves of one aux. engine at left. 4. Crank case of starboard engine opened, showing section of crank and piston rod and part of gearing to operate fuel pumps, etc.

The Motorship Chile, Recently in American Ports

THE M. S. Chile, newest and largest of the big Burmeister & Wain Diesel engined steel motorships that has yet appeared in the western world, made two stops at San Francisco within the last few months, on its first round trip between Copenhagen and Pacific ports. The Chile, built 11 months ago, is operated by the East Asiatic company, Ltd., of Copenhagen, (represented in San Francisco by Otto Jelstrup), which is building a large fleet and will have vessels calling at Pacific ports at frequent intervals on the run between Europe and the Orient.

The Chile has a cargo capacity of something over 10,000 tons, in addition to 1,200 tons of bunker oil. In general construction, design and finish is the equal of the most modern steamships of her size and class. Her net tonnage, Lloyd's Register, is 3,490.49, or 5,569.94 gross (13,400 tons displacement). Though primarily a freighter, she has very comfortable accommodations for a number of passengers. She is 425 ft. 5½ in. long over all; 55 ft. wide, and her greatest depth of hold is 38 ft. 6 in. Light, she has an average draft of about 9 ft.; while with 9,400 tons of cargo she draws 26 ft. 6 in.

The bottom is equipped with the usual water-ballast tanks between frames, which are used to contain bunker oil. These are divided by fore-and-aft bulkheads along the keel, with transverse bulkheads making six separate tanks along the bottom, and two higher up. This gives a bunker fuel capacity sufficient for about 120 days, or enough as a rule for any round trip, without in anyway encroaching on the cargo space. Thus, on the present voyage, oil for the Asiatic run and return was taken on at her first visit to San Francisco; and on the second stop, she took on enough to carry her to Europe and back. On trips via Suez she can take bunker oil at Singapore or Borneo. The tank arrangement makes it easy to trim ship as cargo or weather require.

The hull in general is of standard steel freight type, with maximum cargo capacity and every modern convenience for handling same.

The steering mechanism is of considerable interest, being one of the first of the kind seen on this coast. It is of the electro-hydraulic Helie-Shaw type, made under English patent by Hasties, and is considered by the engineer to be the cheapest steering gear to operate, using a current of 8 Amp. at sea. It can be operated either from the bridge or aft, and hand steering gear is also provided for emergencies. The small wheel on the bridge operates a piston, moving glycerine in two small pipes which run below to the steering appliances in the extreme stern. Here, pressure one way or the other operates an electric motor-driven pump, moving water in large cylinders, the pressure of which against the pistons regulates the position of the rudder.

In such a vessel the boiler space is, of course, saved entirely for cargo; and in the Chile, the engine room with all auxiliary equipment is very compactly arranged, taking up a minimum of space in the hold.

The propelling power is furnished by twin 6-cylinder 4-cycle Diesel engines of the latest model made by Burmeister & Wain, of Copenhagen. The cylinders are of 630 mm. diameter by 960 mm. stroke, with a total rated power for the 12 cylinders of 3,150 h. p. at 125 rpm., the normal speed at sea being 124 to 128 rpm. A remarkable feature of these engines, however, is the slow speed at which they can be operated, as they will run steadily for considerable time, when desired, at as low as 42 rpm. A propeller of 10 ft. pitch is used.

A difficulty in describing such engines is the close interdependence of the main engines and auxiliary machinery. A matter of prime importance, however, is the high pressures involved in the operation, requiring a constant and abundant supply of air under very heavy compression: 60 to 65 atmospheres being required for the injection of fuel into the cylinders. Powerful 3-stage air compressors are accordingly made an integral part of these engines, being operated directly by the main crank-shaft, and placed at the forward end of the engines. They are large enough to give sufficient air at 40 rpm. These compressors pump into two heavy air flasks, which are placed between the two engines, and

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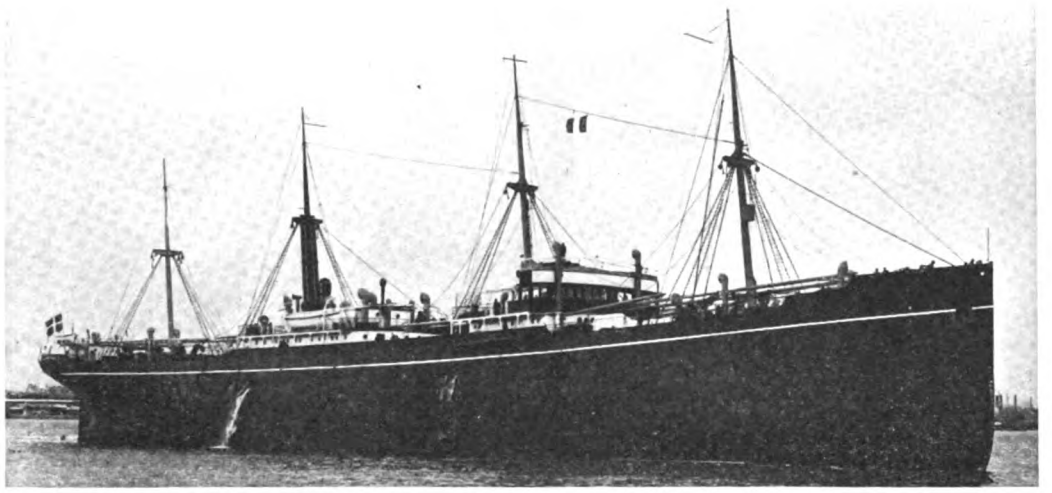
can stand a pressure of over 1,000 lbs. per sq. in.

These flasks are only for injection air. Compressed air is also required for starting, at lower pressure (about 25 atmospheres) but in much greater volume. This comparatively low-pressure air is contained in two tanks of some 500 cu. ft. each, suspended from the deck above on the starboard side of the engine room.

Air for these tanks is furnished by an auxiliary air compressor, operated by an electric motor of about 90 h. p., using current at 340 amp. This compressor, running at 250 rpm., handles about 7 cu. metres of air per minute. Besides pumping up the starting-tanks, this compressor is able, with one of the main compressors, to keep up the necessary injection pressure for full-load operation of both main engines.

Further provision, also, is made against the possibility of running out of compressed air for starting and injection. At the after end of the engine room is a small oil-fired boiler with a working pressure of 80 lbs., intended to furnish steam for heating, baths, etc., for fire extinguishing, and to operate a small 2 h. p. emergency compressor. This compressor can in one hour fill one of the 150-litre air flasks from empty to a pressure of 60 kg. per sq. cm.

All auxiliary machinery on the Chile is operated by electricity, the current being furnished by three large Diesel-engine driven dynamos, located on the port side of the engines. The dynamos are



M. S. CHILE, ONE OF BURMEISTER & WAIN'S RECENT PRODUCTIONS.

of 60 kw. capacity each, and are direct connected to 4-stroke, 2-cylinder engines, of 120 h. p. each at 300 rpm. The dynamos supply current at 220 volts. One of these generator sets is in constant use while at sea, supplying 110 amperes, which is ample for all auxiliary equipment; thus always leaving two generator sets to fall back on in case of accident. Two of the engines are operated in port, the extra current being needed for handling cargo; but there is always one generator set in reserve.

The crank, crosshead-guide, main thrust bearings, etc., are of types familiar in steam engines; the crank shaft being built up. The bearing parts of the crank-shaft are 15 in. thick, and the crank-shaft weighs 25½ tons, with a 7-ton flywheel for each engine. The main engines have water-cooled pistons, with telescoping pipes.

About 30 tons of water per hour are used to cool the pistons, and it is discharged at a temperature of about 45 degrees C. Cylinder pressures are kept as constant as possible, about 6.3 kg. per sq. cm., or 570 lbs. per sq. in. With higher pressures it is found that the cylinder heads suffer more rapid deterioration, and are likely to develop cracks before being long in use. The practice is on the Chile to take the indicator card not less often than every fourth or fifth day. The telescope pipe arrangement has given great satisfaction, the original packing of leather and lignum-vitae being still unchanged and in good condition after ten months of constant use.

There are two sets of motor-driven centrifugal circulating pumps for water-cooling the engines. These have a capacity of 75 tons per hour, against a head of 25 metres, operating at 1,000 rpm., using current at 220 volts, 32 Amp. Each pump has a suction from the engine room bilge, and from the sea on both sides of the engine room; an improvement being the placing of the starboard inlet 6 ft. higher than the other, for use in shallow water.

The reversing mechanism is of a new patented design, the Chile being one of the first ships equipped with it; and it has given a most satisfactory performance, according to the engineer. All control levers for starting and reversing mechanism, etc., are centrally located, one set on each engine, giving great facility for all ordinary manipulations. To reverse from full speed ahead to full speed astern requires only 30 seconds. Each cylinder has its own fuel pump, and can be regulated separately from the others, facilitating close pressure control and adjustment under working conditions. Each main shaft also has a worm gear connected with a small motor, to turn over the crank-shaft.

At the forward end of the engine room is carried a large tank of light oil, for emergency use in starting, etc., but it has never been necessary to draw on this tank, the regular California fuel oil furnished by the Union Oil company having been handled by the engines without difficulty at all times.

There is a large settling tank to which the oil is pumped from the bunkers, to permit the segregation of any water or dirt that may have gotten into the oil. This is a matter of considerable importance, as the introduction of any water into the cylinders with the oil is dangerous, and even at best causes a tendency to fouling. There are also two 6-ton daily run fuel tanks in the engine room, which are drawn upon alternately. A special pump of 50 tons per hour capacity is used to pump the oil into the settling tank, or from one tank to another.

Two sets of pumps are used for forced lubrication, operating at 300 to 400 rpm., according to oil pressure. At sea, with a pressure of about 1 kg. per sq. cm., the pumps handle about 12 to 18 tons of oil per hour, running on 15 to 20 Amp. current. There is a lubricating oil tank for each main engine, carrying 6½ tons of oil.

Other auxiliary engine-room equipment includes: two sets of bilge and sanitary pumps; on each set are two pumps for the bilge, of 20 tons per hour capacity, and one pump for the sanitary tank, of 15 tons per hour capacity, each set being operated by a motor at 20 Amp.; one ballast pump of 150 tons per hour capacity; one motor-generator set furnishing 110-volt current for lighting, with a capacity of 16.5 kw. at 1,000 rpm.; and one motor for operating the lathe, drill-press and other tools in the repair shop.

With engines at about 125 rpm., the Chile's average sea speed has been about 11.1 knots. At this speed the fuel consumption of the main engines at sea is about 10 tons per day, or 135 grammes per indicated h. p. The auxiliary engines, with one running at sea, use .170 tons fuel oil per day, or 145 grammes per indicated h. p. In port, with two engines running, the auxiliaries use .4 to .5 tons per 24 hours (about 3 bbls.). The consumption per day at sea of cylinder oil is about 15 kg.; of compressor oil, about 4 kg., besides about 3 kg. in hand lubrication for both main and auxiliary machinery. With more or less leakage, the loss of oil in forced lubrication varies considerably.

Careful attention and close adjustment are of course essential to the successful operation of this type of engine, mechanical precision in handling as well as in construction being of more importance than with the steam engine. The Chile's engines have been handled in a competent manner, and have given no trouble of any consequence whatever since their installation. Owing to the enormous strains and high temperatures to which the cylinder-heads and valves are subjected, and the necessity of having these parts in good condition, three spare cylinder-heads are carried, in addition to a number of extra valves for all engines; but the original cylinder-heads of the Chile have not been changed, and are apparently still in perfect condition. The spare valves are used in alternation, all being kept carefully adjusted. This is her second voyage, the first having been through Suez to Chinese ports and return; and in that time the entire cost of engine-room repairs is $39, which was Moore & Scott's bill for some work on one of the auxiliary engines during her first stop at San Francisco. No repairs that could not be handled by the regular crew have been done on the main engines. One spare piston for the main engines is carried, but has not been required. One principle observed in caring for these engines has been not to wait for trouble to develop, but to take out most of the valves two or three times on each voyage for overhauling and adjustment. This work is usually done in port; but on the slightest hint of engine trouble at sea that engine is immediately shut down and adjusted. Such incipient disorders have thus far caused only a few short stops. During stops in port in the first voyage, all pistons of the main and auxiliary engines were overhauled, and were all in good shape. During the present voyage, all the pistons in the auxiliary motor compressor were overhauled, besides the port main compressor. During the last stop in San Francisco, on overhauling the cranks, crossheads and main bearings, there was found to be only a little more space between the bearings (.05 to .1 mm.) than six months before. The engineer believes that the metal in a pressure-lubricated Diesel engine will last much longer than in a steam engine of the same size.

According to figures from the engineer's record, on the present voyage out of Copenhagen to San Francisco, to the Orient and back to San Francisco, the port engine ran 1862.24 hours full speed and 42.14 hours slow, when going into port and through the Panama Canal; making 1905.38 hours of actual operation, with two stops at sea totalling 6.25 hours. The total revolutions made by this engine on this voyage were 14,036,870. The starboard engine ran 1866.49 hours full speed, 42.14 hours slow, or 1910.03 hours altogether, with a total of 14,083,170 revolutions. It was stopped three times at sea, with a total of only 2 hours stop. The distance traveled on the entire voyage —from Copenhagen to Christiania, Stornoway, St. Thomas, Colon, San Francisco, Yokohama, Kobe, Shanghai, Kobe, Yokohama, San Francisco—was 20,450 miles; and for the whole distance traveled at sea the speed was 10.94 miles per hour. From Yokohama to San Francisco, with little cargo, the speed was 11.44 m. p. h. at 128 r. p. m. The fuel consumption of the main engines, using Union oil, from California, for the entire voyage was 796.35 tons. The electric lighting engines during the same time used 7.4 tons, and engines furnishing current for the winches, 16.9 tons, making a total of 828.9 tons for the entire voyage so far.

During the same time the amount of lubricating oil used was 1845 kg., including cylinder, compressor and small bearing lubrication of both main and auxiliary machinery. Of the pressure-lubricating oil there was a loss of about 2.5 kg., largely due to cleaning out of lubricating oil tank during the stop at Shanghai.

The running time of the auxiliary engines during this voyage was as follows: No. 1, 1088.45 hours; No. 2, 1240.20 hours; No. 3, 1312.15 hours.

One of the most essential and most laborious features in the operation of this type of engine is the overhauling of the valves, which should be done at least once each voyage for both main and auxiliary engines, putting in new packing, etc., and making the fine readjustments necessary for perfect operation. In view of the great number of valves, this is something of a task; but facilities are provided to handle the work expeditiously. A bench especially equipped for this work is placed at the forward end of the engine room, and two overhead cranes run around the engine room above the engines, so that either valves or cylinder heads can be lifted and moved without trouble. The operations of removing and replacing the various parts have not been very closely timed; but it is stated that a cylinder-head, with all valves, may be removed and replaced within about 7 hours; and similar time is required to remove the compressor piston.

The following will give an idea of the amount of value overhauling required. During this voyage there were overhauled, on the main engines, 12 exhaust valves, 3 times equals 36 valves; 12 fuel valves, 2 times equals 24 valves; 12 starting valves, 1 time equals 12 valves; 12 air valves, 1 time equals 12 valves; 36 fuel pump valves, 1 time equals 36 valves; 19 compressor valves, port engine, 3 times equals 57 alves; 19 compressor valves, starboard engine, 1 time equals 19 valves. Total, 196 valves overhalued on main engine for this voyage.

On the auxiliary engines, on each of the three, 2 exhaust valves and 2 fuel valves were overhauled twice; 2 starting alves, 2 air valves, 2 safety valves, and 2 fuel pump valves were overhauled once; and 4 compressor valves were overhauled twice, making a total for the three auxiliary engines of 72 valves overhauled.

The engine room crew consists of four engineers, five assistant engineers and four oilers.

Engine-room temperature on the Chile are always moderate, and usually as comfortable as those on deck. The highest recorded is 37 to 40 degrees, C., between Panama and Colon; and it has been as low as 26 degrees C.

The master of the Chile on this voyage is F. Grue, with M. Moller as first officer, and F. W. Moller as chief engineer.

The Chile is a little larger than the Panama, a vessel of the same line; and her sister ship, the Peru, recently at Chinese ports, is expected at San Francisco in the near future.

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Oil Engine Nomenclature

What the Diesel Cycle Really Is. How This Term, and That of Semi-Diesel, Constantly Are Used Erroneously

UNFORTUNATELY there is being made a general misuse of the terms "Diesel" and "semi-Diesel" in their application to oil engines, and this misuse, while largely to be found in semi-technical journals, is not confined to them alone but can be seen in many manufacturers' publicity announcements. In the first mentioned instance it usually is done in ignorance, whereas in the second case it often is due to the advantages to be gained by adopting a term which has received such wide publicity of recent years. Much confusion thereby is caused. In the past even this journal has not altogether been blameless, due to hasty scanning of contributed matter sent in by local correspondents in some of the earliest issues.

The Diesel internal-combustion-engine is of the constant-pressure type, and is named after the late Dr. Rudolf Diesel, of Munich, Germany, who invented and patented the cycle of operations on which it works. There are many types of internal-combustion-engines, some of which are closely allied to the Diesel principle. There are others entirely different, and the origin of which is lost, due to having passed through so many stages. But not so the Diesel engine, for over its history there is no doubt, and there seems to be every indication that this name will be applied to it until the cycle is displaced by one more efficient and even more satisfactory in operation—if ever invented. Although the expression "Diesel" conveys nothing of the actual working of the cycle it has become firmly established. It is distinctive and so should be honored as a tribute to the memory of the genius who invented an engine more efficient than any other class of power.

Sometimes one will see a statement such as "the m. s. 'Blank' is fitted with two 400 h. p. Diesels." Such an expression obviously is incorrect. Most manufacturers who build Diesel engines refer to them as Diesel-type, because it conveys the impression that theirs is an engine of their own design that uses the Diesel cycle of operations, the original patents having expired half-a-dozen years ago, and at the same time renders clear the fact that the late Dr. Diesel was in no way responsible for the mechanical feature of the design of their engine.

Incidentally there has been a rumor afloat that the only American company legally entitled to use the term "Diesel engine" is the Busch-Sulzer Co., of St. Louis, Mo., successors to the American Diesel Engine Co., who originally controlled the American patents. This concern apparently has generously made no attempt to prevent other domestic manufacturers from using the name, although there is some reason to believe that they still are entitled to its sole use. Therefore, in deference to their generosity, other manufacturers of Diesel engines should always term them Diesel-type engines. It is not meant, of course, that the patents still are in operation but merely the good will of the trade-name. Any maker is legally entitled to use the term "Diesel-type engine," in our opinion.

It is difficult to believe how much confusion there really exists. Only recently a member of a well-known firm of ship-brokers, (who have been responsible for the ordering of a large number of surface-ignition type oil-engined auxiliaries) remarked, "There is only one Diesel engine and that is the B. & W., all the others are of the Diesel type."

In view of such cases it is obvious that there is urgent need of a proper explanation of the Diesel cycle.

There are two essential elements of characterization in the true Diesel cycle that are not found with any other class of engine and there is a third essential feature; but which is not so rigidly confirmed in its application.

The three fundamental features are as follows:

(1) Compression of pure atmosphere to a degree that the temperature produced is adequate to the inflammation and combustion of the fuel.

(2) Injection of fuel at such a rate that the burning proceeds without rise of pressure on combustion space. (This condition is not realized with absolute precision, there always being a slight rise of pressure when the fuel begins to burn.)

(3) The injection of fuel by air-blast that produces turbulence needed for good combustion. (This is essential but not distinctive or exclusive to the Diesel cycle.)

Now, an engine either has these features or does not have them, and correspondingly is of the Diesel type or it is not.

Of all internal combustion engines other than those of the true Diesel type the nearest approach to the Diesel cycle is that of the Sabathé motor, which is one of the oil engines adopted by the French government in their submarines. This engine operates both on constant-volume and constant-pressure. It is mainly of the four-cycle Diesel type with compressed-air injection, and the atmosphere in the working cylinders is compressed to about 450 pounds, as with the ordinary Diesel design. However, there is a double needle-valve. The first part of the needle lifts and admits a small part of the fuel into the cylinder and combustion commences. As the needle lifts projecting pieces of metal lift the main valve and the balance of the fuel is admitted, the air-blast being used in both actions. Fuel consumption lower than that of any other design of oil engine has been obtained with the Sabathé motors. Speaking from memory of a test report we once saw it is 0.34 pounds per b. h. p. hour. In any event we know it is between threetenths and fourtenths of a pound per brake horsepower per hour.

With some of the Vickers oil engines in British submarines air-injection of fuel was replaced by a powerful spring injection, which sprayed the fuel at a rate high enough to atomize it sufficiently to make its use practical and thus enable air compressors to be dispensed with, which is important in the case where the space is limited such as in a submarine. Except for this one feature the Vickers engine is of the true Diesel cycle, the same cylinder compression being used.

A domestic oil engine that has not yet been applied to marine purposes, which has been very successful in stationary practice is one of the De la Vergne models. This is an engine that is not unlike the Diesel as it has injection of fuel by air and it uses a fairly high cylinder compression (275 lbs. per sq. inch); but further ensures sufficient heat for combustion by utilizing a "hot-bulb" vaporizer.

The class of oil engine which is being so indiscriminately termed "semi-Diesel" is the surface-ignition, or hot-bulb, motor. With this system there is an exhaust-heated bulb or vaporizer, on top of the working cylinder into which the fuel is injected in the form of a spray and combusts upon striking the heated surface. There are various forms of the surface-ignition engine. Among better known (in America) of such motors are the Bolinders, Fairbanks-Morse, Skandia, Avance, Remington, Kahlenburg, Petter, and Mietz. The makers of the first named engine are very strongly opposed to the erroneous use of the misleading term "semi-Diesel." Apparently the old Hornsby-Ackroyd engine is the original surface-ignition, or hot-bulb engine but several claims have been made in the past. Hence it is best to use some term that describes its main principle of operation, which the word surface-ignition does. "Hot-bulb" does not quite cover all the variations which include "hot-ball," "hot-plate," "hot-pot," and in one instance the hot-surface of the piston is utilized on which to spray the oil.

This article would not be complete without mention of engines of the dual heat ignition type such as the Burnoil, which is fully dealt with in this issue (February). With the system, which was invented by a Hollander, and afterwards adopted by German, British, American and other engineers, high cylinder compression is used (450 lbs. per sq. inch), but air injection is dispensed with. The oil flows to the needle valve by gravity and is admitted into a little perforated cup inside the combustion chamber. The heat of the compression fires the vaporized surface of this oil and a miniature explosion occurs, and the oil is forced through the holes into the cylinder and complete combustion occurs. With light residual-oils very economical consumption has been obtained, but it has not yet been built in sizes over 100 b. h. p. In Europe it is distinguished from other oil engines by the term "Brons-type," this being after the name of the original maker.

"STANDARDIZED MOTOR SHIPS."

In our November issue we drew attention to the successful efforts of one Pacific Coast ship yard which had standardized their type of auxiliary lumber schooner and in consequence receiving orders in such numbers that contracts for six such vessels were farmed out to other ship yards, their own being loaded to capacity. The straight motorship is now being recognized and the standardizing of a suitable type is awaited by many prospective motorship owners. A good allaround wooden vessel, well constructed, with unobstructed deck space for a lumber cargo, deck auxiliaries and equipment of a standard pattern for the speedy handling of mixed cargoes is the vessel in demand.

Three sizes could be standardized.

(1) The offshore vessel for Australian trade of from, say 280 to 300 feet in length.

(2) The coasting vessel of smaller dimensions like "Sierra" plans in November issue of Motorship.

(3) The home port freight barge for protected waters.

These types will be money-makers and enable three separate yards to take up this work right away without stepping on each others' toes.

Competitive shipowners elsewhere in the world are ordering standardized motorships identical in type and power. One Copenhagen firm has 16 sister motorships on hand for five different firms. These being the East Asiatic company of Copenhagen, Mr. Fred Olsen of Christiania, the Swedish East Asiatic company of Stockholm, the Norwegian-Mexican Gulf line, and the Norwegian-African-Australian line.

These steel ships are 435 feet in length overall, beam 55 feet, depth 30 feet 6 inches, draught 26 feet 5 inches (5,560 gross). The machinery installation consists of Diesel type engines developing 3,100 i. h. p. on twin screws, giving a normal speed of vessel at about 11¼ knots. The type has been found eminently adapted for practically every type of cargo carrying trade along the sea routes of the world, including the west coast of America.

A second standardized motorship of which a large number are being built, has a length of 367 feet overall with 2,000 i. h. p. Diesel type engines, speed 10¾ knots. There are between 50 to 60 motorships of these standardized types now in construction today in Scandinavia.

These are steel vessels similar in type to those now under construction at Seattle Construction, Skinner & Eddy, Duthie and Portland shipyards. These vessels are being equipped with steam because large oil engines in such quantities were not obtainable on time.

Now the question is how large dare we go with wooden motorships? Three hundred feet is thought by many as being about the limit, and this size has so far not been exceeded by the Pacific Coast auxiliary schooner, but straight motorships with increased power will be controlled in size for the time being by the Diesels obtainable.

HOW GERMANY SECURED SOME SUBMARINE ENGINES.

In 1913 the Russian Admiralty placed an order with Krupps of Kiel-Gaarden, Germany, for a series of submarine-type Diesel engines, each of 1,500 b. h. p. These must have been nearing completion when war broke out two and a half years ago, and would partly account for the large number of submarines that Germany was quickly enabled to place in operation.

CONVERTING MERCHANT SHIPS.

Recently a large steamer was converted into a sailing-ship at the Moore & Scott Iron Works, Oakland, California, which is rather a different step than that taken by Vimont & Co., ship owners, of Marseilles, France, who took one of their largest sailing ships, cut down the masts, lengthened her 50 feet, and installed two 1,100 i. h. p. 4-cycle-type Diesel oil engines for propulsion purposes, thereby making her a large full-powered motorship.

The Society of Automobile Engineers is to be reorganized and the name changed to the Society of Automotive Engineers, and on the Council representatives of motorship engineering, aeronautic, and tractor fields are to be considered at the January 11th meeting. Also it is quite possible that the engineers affiliated with the members of the National Association of Engine and Boat Manufacturers will join the S. A. E.

This means that the activities of the combined organization will include standardization work in the design and construction of engines for motorship propulsion.

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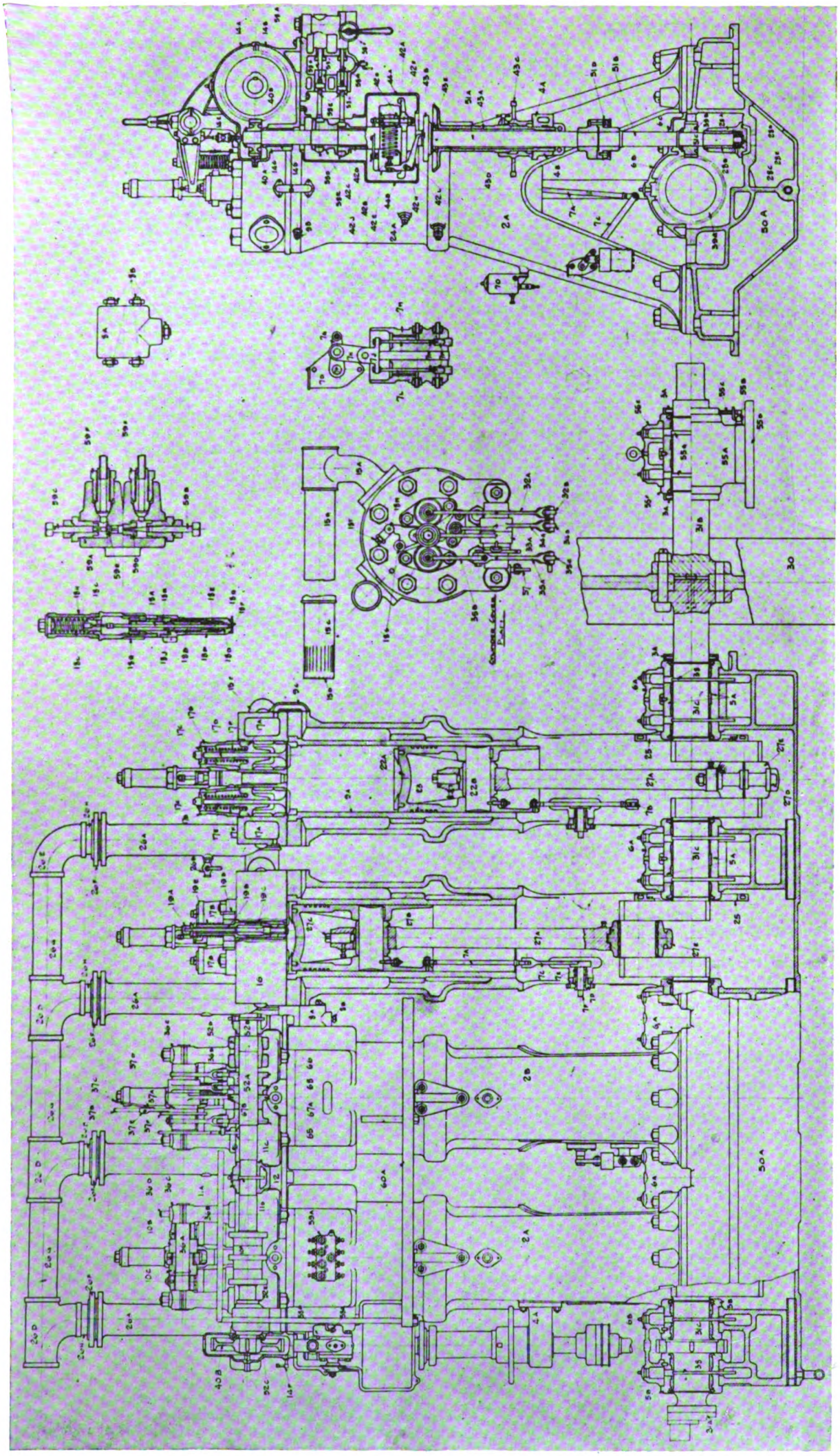
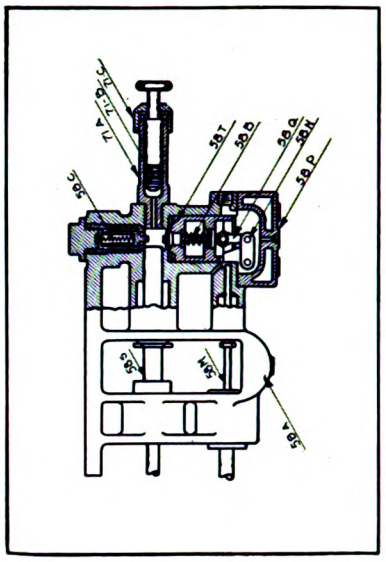


NUMBERED PARTS DRAWING FOR FOUR-CYLINDER STATIONARY MODEL DOW-WILLANS DIESEL TYPE OIL ENGINE.

2—A frame; (a) Gov. line; (b) non-governor line. 3—(a) Shaft gland. 4—Bracket for vertical shaft; (a) bracket; (b) cap. 5—Main and Gov. end bearings; (a) main bearing, top and bottom halves complete. 6—Covers for Gov. and main end bearings; (a) main bearing cover; (b) Gov. end bearing cover; (c) cap. 7—Lub. oil pump and drive; (a) tube complete with link ends; (b) bushes (2); (c) rocking lever; (d) bearing with lid; (e) bushes (2); (f) spindle; (g) crank, including pins; (h) connecting link; (j) guide, including gudgeon pin; (l) plungers; (m) pump body, including valve covers (2), and union nuts (4); (n) valves (2); (p) valve springs. 8—Pipe fittings; (a) five-way junction piece; (b) union with nut. 9—Cylinder; (a) removable liner; (b) pieces; (a) camshaft; (b) valve lever shaft; (c) bush distance piece. 11—Camshaft bearing; (a) bearing cap. 12—Bridge packing piece. 14—Gear case and packing piece; (a) cover; (b) gear case; (c) bearing cap; (d) bush; (e) sight-feed oil cup; (d) oil cup sight. 15—Distance dished end; (e) connection. 16—Cylinder cover including bush. 17—Suction and exhaust valves; (a) valve seat; (b) cover; (c) valve guide; (d) suction valve, including cap nut; (e) exhaust valve, including cap nut; (f) spring. 18—Fuel valve; (a) needle; (b) tube; (c) seat; (q) valve box; (r) stuffing box with neck ring, gland and gland nut; (s) union with nut; (t) nut; (b) bush; (c) valve body; (d) flange; (e) spring. 22—Piston; (a) piston; (b) cross head pin and key; (c) locking screw with locking plate. 23—Piston rings. 24—Piston and cross head lubrication; (a) check valve complete; (b) injection tube. 25—Centrif. lubric. complete with tap bolts & through bolts. 26—Exhaust pipe; (a) exhaust pipe; (b) smoke cock; (d) three way connection; (e) elbow; (f) companion flange; (g) long pipe nipple; (h) short pipe nipple. 27—Connecting rod; (a) connecting rod; (b) bearing, two halves; (c) adjusting screw; (d) bolts (2) with special nuts; (e) connecting rod ends, in halves. 28—Footstep bearing; (a) bearing; (b) bushing; (c) retainer; (d) ball thrust; (e) register rings. 31—Crankshaft; (a) crank pin; (b) extension shaft; (c) crankshaft. 32—Suction valve lever; (a) lever with roller pin and bush; (b) roller (not shown); (c) spherical washers concave and convex 34—Starting valve lever; (a) lever with roller pin and bush; (b) roller; (c) spring. 35—Exhaust valve lever; (a) fulcrum end with roller pin and bush; (b) striker end; (c) roller. 36—Valve lever shaft and columns; (a) valve lever shaft; (b) column; (c) lever; (c) catch; (d) springs; (e) pin; (f) stop plate. 37—Starting gear; (a) driving wheel; (b) driven wheel 40—Helical wheels for camshaft drive; (a) driving wheel; (b) driven wheel. 42—Governor; (a) governor disc; (b) adjusting screws; (c) eccentric sleeve; (d) bush; (e) weights (2); (f) spindles (2); (g) cups (4), cones (2) and balls; (h) adjusting cranks (2); (j) connecting links (2); (1) springs. 43—Gov. actuating gear; (a) sleeve; (b) thrust plate; (c) hand wheel; (d) bushes; (e) ball thrust Hoffman washer. 44—Governor guard; (a) guard; (a) back half; (b) outer half. 50—Bed plate; (a) bed plate; (b) bibcock (not shown). 51—Vertical shaft; (a) top part with half coupling; (b) bottom part with half coupling; (c) thrust block; (d) cover for coupling. 52—Camshaft; (a) governor end half; (b) flywheel end half; (c) thrust collar with oil thrower; (d) coupling with rings; (e) loose collar. 55—Outer bearing and sole plate; (a) pedestal; (b) block; (c) oil sight; (d) sole plate; (e) cover; (f) bearing top and bottom halves; (g) Saxon oil rings. 57—Compression easer. 58—Fuel pump; (a) pump casing; (b) inlet valve and spring; (c) outlet valve and spring; (d) eccentric straps (2); (e) eccentric rods and bushes (2); (f) eccentric shaft and pointer; (h) metallic packing for the trip gland (not shown); (j) guide piston with pin for plunger; (l) guide piston with pin for regulating spindle; (m) regulating spindle and gland; (n) trigger; (p) circulating cover; (q) connecting link; (r) eccentric and cover; (s) pump plunger and gland; (t) displacing piston. 59—Fuel distributer; (a) distributer body; (b) regulating needle with plug and nut; (c) adjustable valve stop with plug and nut; (d) seat for needle; (e) —Exhaust cam. 66—Suction cam. 67—Fuel valve cam; (a) cam; (b) adjusting piece. 68—Starting valve cam. 70—Box lubricator. 71—Flooding pump; (a) casing; (b) plunger; (c) cap nut..

NUMBERED PARTS DRAWING FOR FOUR-CYLINDER STATIONERY MODEL DOW-WILLANS DIESEL TYPE OIL ENGINE.

BELOW: FUEL PUMP AND DISTRIBUTER



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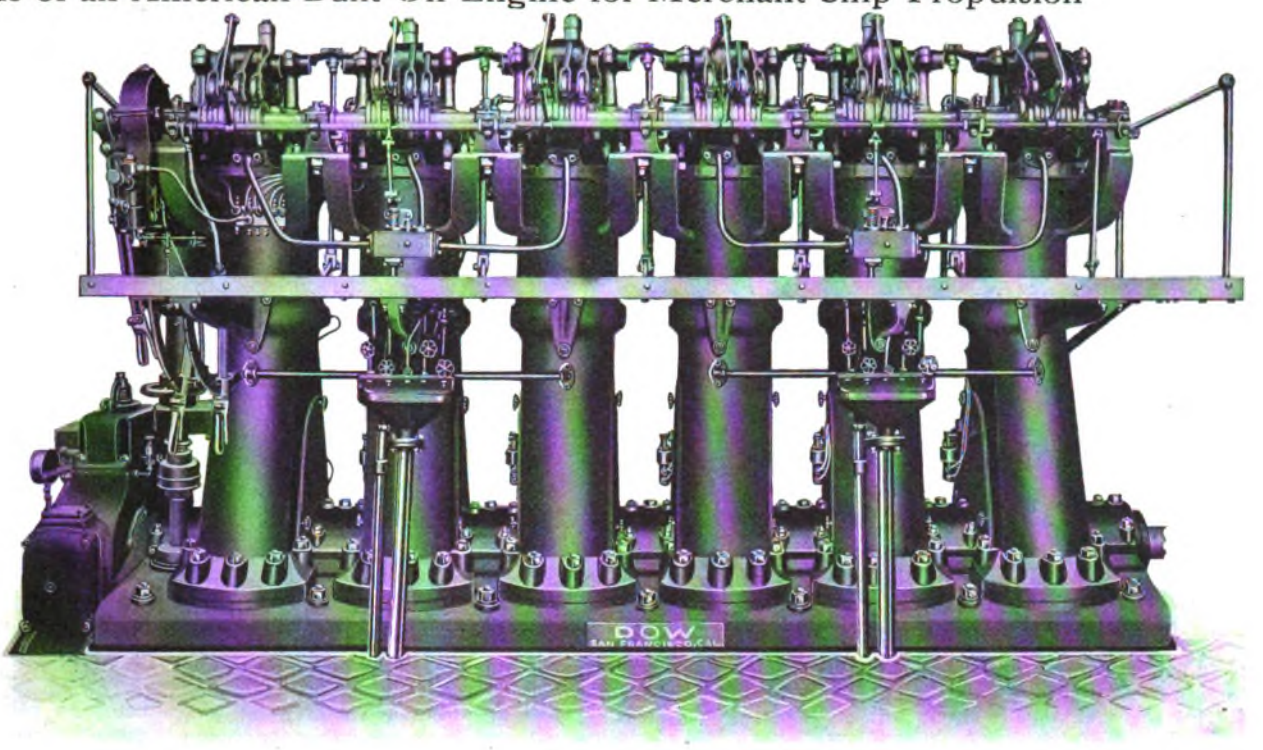
Pioneer Pacific Diesel Builder Brings Out Marine Model

First Details of an American-Built Oil Engine for Merchant Ship Propulslon

THERE appears to be quite a little diversity of opinion among American engineers as to whether the policy of adopting a foreign license to build Diesel engines is better than designing and developing a domestic production, or vice versa. There can be but little doubt that constructing some European engine that already has proved itself successful is the most economical from a commercial point of view; because, all the tedious initial experimenting is dispensed with, also because the costly necessity of ascertaining the weaknesses of a new motor (which only can be discovered when it is in service under ordinary sea-going conditions, although, of course, much is revealed by the early test-bed trials) is avoided. A number of ambitious companies, however, prefer to accept the responsibility of handling everything themselves from its inception, utilizing their previous gasoline or steam engine experience to produce satisfactory results. Thus, when they do obtain success, greater credit and glory is due to them for their fine initiative and enterprise.



HEAVY DUTY DOW-WILLANS DIRECT REVERSIBLE MARINE DIESEL OIL ENGINE.

Somewhat different steps from either of these have been taken by the Dow Pump & Diesel Engine company of Alameda, Cal., in the production of their new marine Diesel-type oil engines. For some years they have been building a very successful stationary Diesel-type engine, being the sole U. S. A. licensees of Willans & Robinson, of Rugby, England, whose motors are operating central stations, pumping plants, etc., all over the world. In turning their attention to marine work the Dow company designed their own marine set; that is to say, they have maintained the principal features of the Dow-Willans stationary motor, which has had plenty of opportunities of proving its worth, and have altered and added such parts necessary to make it adaptable for marine practice. Generally speaking there are no structural differences other than the addition of extra cams, levers, etc., required for the reversing feature. They are preparing to build in the following sizes:

B.H.P.	No. of Cyl.	Bore	Stroke	Weight (Approx.) Tons
160	3	305 mm. (12 in.)	460 mm. (18.1 in.)	14¼
220	4	305 mm. (12 in.)	460 mm. (18.1 in.)	19
330	6	305 mm. (12 in.)	460 mm. (18.1 in.)	29
250	3	380 mm. (14.9 in.)	560 mm. (22 in.)	22¼
335	4	380 mm. (14.9 in.)	560 mm. (22 in.)	30
500	6	380 mm. (14.9 in.)	560 mm. (22 in.)	44¼
700	4	510 mm. (20 in.)	720 mm. (28.3 in.)	62
1000	6	510 mm. (20 in.)	720 mm. (28.3 in.)	89¼

The tonnage weight is taken as 2,240 lbs. to a ton.

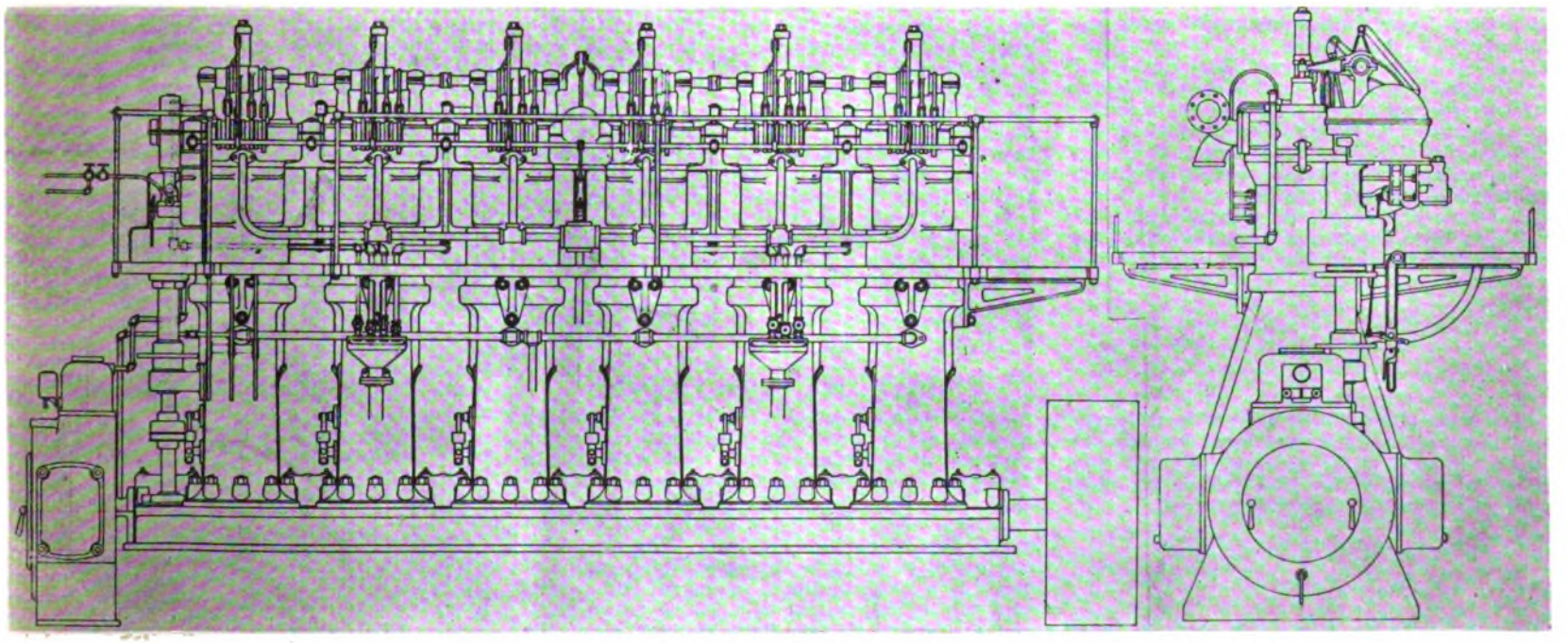
These models will cover quite a number of sizes for which there is a very large demand on the Pacific coast. They are of the A-frame type, with special oil-tight guards to the crank-pits, which while enclosing the oil, can readily be removed for inspection of the crank-pin, and cross-head-pin without stopping the engine. As long trunk-pistons are used the makers decided not to adopt crossheads and guides, which they consider unnecessary with this type of piston, preferring to obtain the advantage of limiting the total overall height and weight of the engine to a minimum. Following accepted practice the cylinders have separately cast liners.

The cylinder heads are detachable and carry the brackets that support the rockers for operating the valves. On a level with the cylinder heads is the camshaft which carries both sets of cams for ahead and astern motions of the engine, this method eliminating the use of short or long push-rods, the cams actuating the hardened steel rollers of the rockers direct without any intermediate mechanism. The cam-shaft itself is driven by enclosed helical gearing from a vertical shaft the lower end of which is operated off the main crankshaft at the forward end of the engine.

On this vertical shaft is mounted the governor and eccentric for driving the fuel-oil pump. Here is a feature which gives evidence of careful study of the best European practice for they have adopted a single-fuel pump for all cylinders, instead of individual pumps for each cylinder, the latter system requiring very delicate adjustment, whereas by fitting one big pump regulation becomes a more simple task. It is a constant-stroke single-plunger model with a very sensitive regulation device giving, it is claimed, great accuracy in control. Incidentally it may be said that the by-pass principle of regulation has been abandoned by them. There are three fixed positions for each control lever, namely, starting, stopping, and full speed, the intermediate positions from stop to full speed being graduated to give a range from full speed to 35 per cent. of full speed.

Governing is by the Dow improved centrifugal-type and operates directly on the supply of fuel-oil to the injection-valves, in proportion with the load; at all times retaining the predetermined revolutions. It is mounted on the vertical shaft that drives the cam-shaft, is enclosed, and is furnished with a hand-control device.

With a little practice the engine can be reversed from 20 to 30 times on one standard size air-



GENERAL PLAN OF DOW-WILLANS DIRECT REVERSIBLE MARINE DIESEL OIL ENGINE ILLUSTRATED ABOVE.

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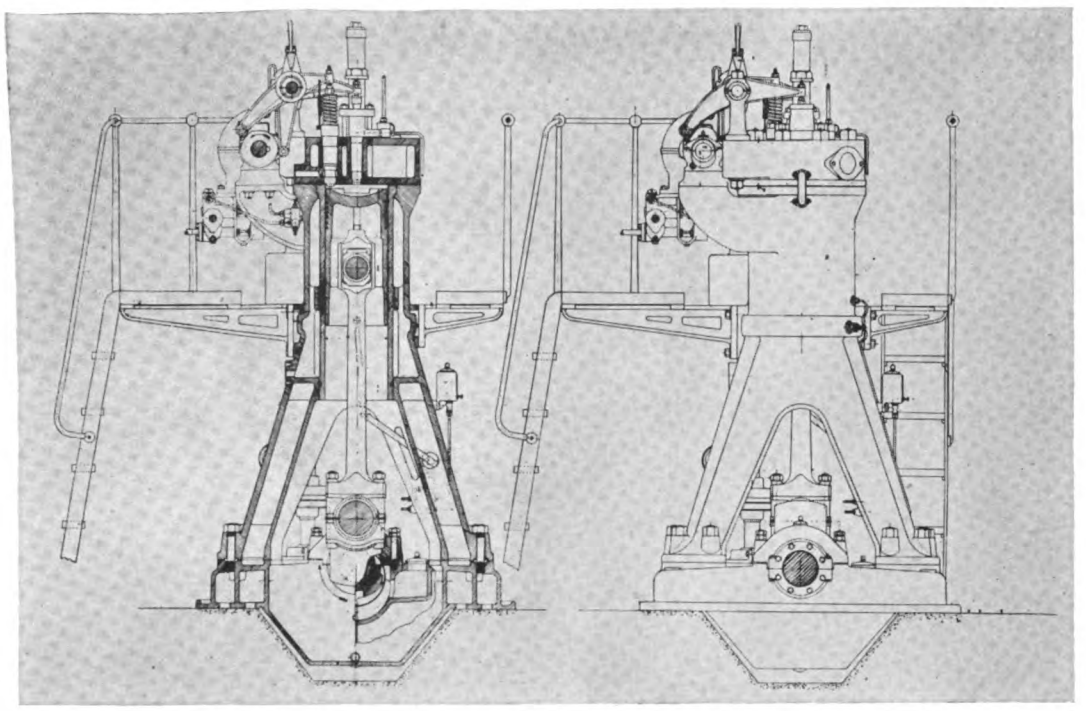

SECTION OF DOW-WILLANS STATIONARY MODEL DIESEL TYPE OIL ENGINE.

reservoir bottle, two of these being supplied with each engine. The minimum pressure necessary for starting these engines is about 200 lbs. per sq. inch; but in general practice the pressure used will be a little higher.

The air-compressor is of the well-known Reavell type, which also has been adopted by many British and Continental European manufacturers. It is of the three-stage type with cylinders and intercoolers entirely immersed in water. The drive is off the forward end of the engine crankshaft.

Tests of Diesel engines always are interesting, and the following is the trial report of a standard Dow-Willans four-cylinder 200 h. p. engine of a normal speed of 200 r. p. m. supplied to the National Ice & Cold Storage Co., of San Francisco. Indicator cards were taken at average intervals of 15 minutes per cylinder.

Fuel Load Test.

Revolutions per minute	250
Total indicated h. p. (mean)	259.52
Mechanical efficiency assumed (from curves sheet No. 3)	75.73%
Total brake h. p. (mean)	196.75
Total indicated h. p. hours	1,557.12
Total brake h. p. hours	1,180.50
Total fuel consumed (6 hours), lbs.	485.75
Heat value of fuel, per pound, B. T. U.	19,649
Fuel consumption per i. h. p. hour, lbs.	0.3119
Fuel consumption per b. h. p. hour, lbs.	0.4114
Heat units supplied per i. h. p. hour	6,129.0
Heat units supplied per brake h. p. hour	8,083.6
Thermal efficiency on basis of i. h. p.	41.5%
Thermal efficiency on basis of brake h. p.	31.48%

There is one matter, however, over which the writer cannot fully agree with the makers of the Dow engine, namely, in their catalogue of stationary motors, which we presume was published some considerable time ago, they discuss the question of oil fuel, and state that a larger proportion than 1 per cent. sulphur will cause corrosion of the working parts.

It has recently been found that larger percentages of sulphur can be used if care is taken to ensure of freedom of water in the oil or in the engine, injury only taking place if moisture is prevalent. It also has been found that very large percentages of asphaltum can be used without noticeable deposits forming.

At the same time it is best to use when feasible oil with as little sulphur as possible. The Dow company quote an oil used by U. S. A. submarines four years ago, as follows:

Calorific value	19,336 B. T. U.'s
Gravity	24 deg. Baume
Flash point	155 deg. Fahr.
Burning point	245 deg. Fahr.
Sulphur	0.53%
Asphaltum	0.21%

To test what oils could be used without danger, one of the leading European Diesel builders ran an engine in their shops under strict supervision and careful attention for long periods on oil of the following analysis:

Calorific value	17,430 B. T. U.'s
Specific gravity at 15 deg. C	0.862
Flash point	140 deg. Fahr.
Sulphur	4.6%
Asphaltum	70.0%

After the tests no noticeable deposits were found, nor was any harm whatever done to working parts. But it must be pointed out that their engine was run and watched by experts. It would, of course, be madness to use such an oil in a Diesel engine under ordinary sea-going conditions. While the advice given by the Dow company is very good from a general aspect, we have mentioned this matter in order to demonstrate that Diesel engines can use oils with a moderate amount of sulphur, and a good proportion of asphaltum (20-30%) without harmful results for general sea-going practice.

Dow Shop Well Equipped.

The Dow Pump & Diesel Engine company, Alameda, Cal., which has just taken up the manufacture of the Willans Diesel type engine for marine use, having manufactured it in stationary sizes for several years, has a large and well equipped shop on the Oakland estuary, and is in an excellent position, not only to get out engines of high quality, but to produce them economically and in quick time. Before undertaking the manufacture of the Willans Diesel type engine four years ago, the heads of the company and its chief engineers made an extended study of Diesel engine construction in Europe, and have kept in close touch with subsequent developments. The company has built and installed a number of large Willans Diesel type engines for use under widely varying conditions on land, and all have stood up well under constant use, some of them under a heavy and varying overload, with surprisingly little attention or overhauling. The company's facilities have also been tested by the successful production of finished parts for high-power marine oil engines of other makes, under contract from other manufacturers.

A strong point in the company's favor is the fact that it produces its own castings, as it has been found rather difficult to get castings from local commercial foundries sufficiently perfect for the delicate adjustment of oil engines. The Dow plant has two large cupolas and a complete foundry equipment, with core-ovens, etc., and a large pattern-shop, besides two Schwartz furnaces for brass and aluminum castings. The machine shop is finely equipped with modern tools, with a very elaborate supply of special tools and jigs for work in this line; and all engines turned out are put through a first-class testing department. Besides the shop equipment mentioned, the company has a frontage of 600 ft. on the Oakland estuary, so that installations may be conviently handled at the plant.

INSTALLING UNION ENGINE.

The schooner "Angel," recently purchased on the Columbia river by the Merchants' Navigation company, of Los Angeles, to be used in the freight and passenger business between southern California and Mexican ports, was brought to San Francisco about Feb. 1 for overhauling and the installation of power equipment. The propelling power will be a single 4-cylinder Union engine of 200 b. h. p. The auxiliary equipment will consist of a 9 h. p. ship windlass, a 6 h. p. cargo hoist, and a 4 h. p. electric light engine, all of the Union Gas Engine company's make.

FOUR 13,000 TONS D. W. C. MOTORSHIPS ORDERED.

An order has been placed with Messrs. Harland & Wolff of Belfast, for four Diesel-driven motorships, each of 13,000 tons d. w. c., all to be completed within the next two years. They will be 470 feet long, so will be the largest motorships afloat, although the power will not be quite so high as the machinery of the U. S. naval motor-tanker, "Maumee."

The Diesel oil-engines will be built by the Burmeister & Wain Oil Engine Co. (England) Ltd., of Glasgow, and develop a total of 6,400 i. h. p. per ship, each installation consisting of twin eight-cylinder motors of 3,200 i. h. p., and the speed will be 13 knots loaded.

For auxiliary purposes there will be three Diesel sets of 160 b. h. p. each, which will drive electric dynamos for the generation of current for operating the steering-gear, deck winches, windlasses, pumps, etc. Contrasting with previous motorships of this design they will be equipped with funnels, so that in outward appearance they will resemble ordinary steamers. At full speed and fully laden the consumption of fuel for all purposes will be from 18 to 20 tons per day, which will mean that only about 600 to 700 tons of fuel need be carried for a round voyage from New York to London—this for a vessel of thirteen thousand tons dead-weight capacity, and an actual cargo capacity of about 12,000 tons.

THREE SHIFTS AT SKANDIA PLANT.

The shop of the Skandia-Pacific Oil Engine company (recently bought from the Gorham Engineering company) is running at full capacity with three shifts, and even at that is compelled to have considerable work done at outside shops. A lot of new tools have already been ordered, but cannot be delivered for some time, and the company has enough business to keep the plant busy for a long time to come. In view of the demand for large engines, it has been necessary to postpone the introduction of the small boat engines in which the local fishermen have been taking so much interest.

The most interesting matter at the Skandia plant at present is the manufacture of a pair of twin 350 b. h. p. engines to be installed at Savannah, Ga., in a large power schooner now building at that place for the Celtic Transportation company of New York. Internal combustion engines have been made in San Francisco before for gulf ports, but this will be the first pair of really large marine engines to be built on the Pacific for installation at an Atlantic coast shipyard. The preliminary work on these engines has just been commenced, the contract having been booked a few weeks ago.

Another pair of 350 b. h. p. engines will also be built shortly for a 290-ft. schooner, the keel of which was recently laid at Andrew Peterson's shipyard at Aberdeen, Wash.

CONVERSION OF LIGHTSHIP "NO. 50."

For many years a familiar object at the mouth of the Columbia River, Oregon, "No. 50" was retired from service during the year 1910 when she passed into the hands of the junk dealer at a price reported to be about $1,500. Some $4,000 in equipment, brass, and copper sheathing is reported to have been recovered from her and the bare hull sold to the present owner for about $2,600.

"No. 50" was a staunchly built composite vessel when turned out in 1891 by the Union Iron Works of San Francisco at a cost of about $90,000. Her dimensions are 110 feet l. w. l. by 22 feet beam by 15 moulded depth and the new arrangement of hold will give her a cargo capacity of 500 to 600 tons. An upper deck is being built at the same level of the former forecastle head and provides considerable 'tween deck cargo space. Accommodation for passengers is provided in ten staterooms aft, on upper deck, cargo hatch separating saloon galley and officers' quarters forward. The wheelhouse and bridge being above same.

The power installation is to consist of a twin set of 110 h. p. Frisco Standard four-cycle heavy duty motors with large fuel tanks in wings of lazeretto and fresh water tanks above, in 'tween decks.

The owner is a native of Mexico, in which west coast trade "No. 50" will be used. The alterations are being carried out by the Joseph Supple's Ship Yard, Portland, from plans prepared by F. Ballin, N. A. When finished "No. 50" will represent an investment of about $40,000.

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Motorship vs. Auxiliary---Timely Observations

(CONTRIBUTED)

In view of there being ten auxiliaries to one motorship under construction today on the Pacific Coast, the question naturally arises, Why? The object of this article, therefore, is to draw comparisons between the two types from an economic standpoint and to invite expert criticism.—Ed.

SINCE our own Pacific Coast with its large and diversified fleet and trade, will furnish examples sufficient for comparison, reference in this article will be had solely to that fleet.

Many years ago when the application of steam to vessels was in its infancy, and the sole trade between Puget Sound, the Columbia river and California ports, southbound, was Washington fir and Oregon pine, with a little coal and some Shoalwater and Yaquina Bay oysters as general cargo, the craft in use were two and three masted schooners; an occasional bark or barkentine, coast built, and a few square riggers of the type of the "Snow & Burgess," the "Oriental" and the "Occidental."

The square riggers and barks plied between Puget Sound and San Francisco, and the schooners, principally, to South Coast California ports, where their light draft permitted them to enter the unimproved harbors, among which were Orange Landing, Newport, Wilmington and San Diego.

The next evolution in the type of carrier, came with the putting in of very light steam power, which began the creation of the coast "steam schooner," first with a regular spread of sail, and eventually the type of today, with not even steadying sails, in most cases.

The first "steam schooner," under steam alone would travel about three to five knots per hour, and the next step in advancement, produced the vessels of the "Alcatraz," "Phoenix" and "Point Loma" type, going about 6 to 8 knots at sea.

We find as the next development, the construction of the "Aberdeen" and "Despatch," with greater power and no sail.

Then the "Rainier" and "San Ramon," big able vessels of the type, with engine power increased, a greater steaming radius, and with no pretensions to the name of schooner except in rig, and with a still greater speed.

Following closely comes the construction of the "steam schooner" in steel, and such notable examples as the "Edgar H. Vance," "Henry T. Scott" and the "Alvarado," successful coast lumber carriers, very large, with a greater proportionate power than any of the previous vessels of the type, fully illustrate the evolution of the auxiliary steam vessel to the full powered vessel of today, and there can be little doubt that this complete change has been fully warranted through the recognition of the fact that the sails were not at all a necessary adjunct to the vessels, and that better results could be obtained with the very largest power consistent with the size of the vessel.

Some thirty years ago there came from foreign ports to the Pacific, in general cargo trade, iron vessels called steamships, but in reality they were auxiliary ships, having small steam installations, or brig rigged sails.

A few years of this type and it was succeeded by larger tonnage vessels, with increased power, good for 8 to 9 knots and with less sail area.

Then followed in its varying large dimensions the modern warehouse freighter, carrying trainloads of cargo, with great power capable of driving the ship 10 to 12 knots, and the entire elimination of sail in any form, practically no masts except for wireless purposes, and with a forest of cargo booms and lifts.

We thus trace the change in off shore carriers and the illustration seems a good evidence that the sails were of limited usefulness, and amply show that there is no good reason for the association of machine power and sails in the propulsion of vessels, otherwise they would have been continued in some form or in some of the important trades, and the ultimate economy is evidently not a vessel with sailing lines, but a full-bodied vessel that could not be handled advantageously with sails, full powered and one in which auxiliary power would be farcical.

For five years past and owing to the more rapid development in Europe of the Diesel principle as applied to marine engines, there have been many old iron and steel sail ships of large and small tonnage equipped with this economical power as an auxiliary, and there is every reason to believe that many of these vessels have been improved upon as cargo carriers through the supplemental power, but there does not seem to be any new large construction of auxiliary sail ships by foreign builders, the single example of the great ship "La France" not being a proof to the contrary, so it may be taken as conclusive that to engine a sail ship and retain its full sail power is basically correct, but to construct a sail ship with design of hull for sailing, and place in auxiliary power, is, or will prove itself to be after experience is gained, quite another matter and entirely speculative at this period, and it seems a fair conclusion that the present auxiliary construction with its installation of small power is prompted more by the low cost of the small power by comparison with full power, rather than by much thought or experience being brought to bear on the requirements or the ultimate result.

It is true, notably in fishing vessels, there will always be the auxiliary association of sail and machine power, because of the necessities in conservation of fuel, the long stops, etc.

In America and on the Pacific Coast, principally, there is building today a considerable tonnage, in wood, of the now well known auxiliary type, with full sail power, mostly in barkentine and baldheaded schooner rig and with twin motors of relatively small power.

These vessels with relation to the kind and size of engines, material, arrangement of hatches, depth of holds and construction are a new type; undoubtedly the basic business of these carriers, the offshore lumber trade, is responsible for the type, but it is a moot question whether they would not have been more able and eventually better earners, if the sails had been dispensed with and full engine power used.

There can be no doubt, facing the success of the steel sailing ship converted to auxiliary, that if an owner had such a vessel he should engine her and retain the sails, for she was built for sailing, is generally too old to be worth expensive changes such as would accompany the removal of masts and rigging and the addition of cargo gear, heavy and costly engines and their auxiliaries, and the addition of engine power gives her a new life; and while the added engines take away valuable cargo space, this is compensated for by the increased ability of the old ship.

With new construction this is a different matter, if the ship is designed to sail, she must have better lines, than as if for full power, so there follows a loss if engines are installed, that need not occur if designed for power.

With the present new type of auxiliary ship we find, a sail crew and an engine crew will have to be furnished, with the full powered vessel, only the engine crew and a deck crew of much less ability, for it takes an experienced man to handle sails, and also the deck crew will be less in number, and while the engine crew will be increased, it will not in wages or numbers in proportion to the gain made in the lessened deck or sailor crew.

It is an assumption that at sea when the wind is "right," the engines will be shut down, and the vessel will proceed under sail, but this is only an assumption, for the ship master is going to use his power, in any form, continuously, so as far as any advantage in the use of dual power is concerned with respect to its separate use, there seems no advantage and full sail or full machine power would be preferable.

If an auxiliary vessel were under sail and the engines are shut down, there is a great drag from the propellers, which is a direct retarder of speed.

There is a marked difference in the rates of insurance as between the full powered and the auxiliary ship, in favor of the former.

As between the two types of vessels, it is clear that a consignee would choose the full powered vessel, were he given a choice at the time of deliverey of cargo, at proportionate rates.

The choice of the consignee would also favor the full powered vessel in the matter of delivery, as there is very much in favor of such a vessel as compared to the auxiliary with its much longer passages.

To an owner the gain in time and service of the fully engined ship, would be, in the course of years, a very important item; take as an illustration; the average sail voyage to Port Pirie from Puget Sound is 75 days; with auxiliary equipment and it working on the theoretical basis of alternate use with the sails, this could be cut to 50 days, a full powered vessel could make the trip, if she were of the ordinary freighter type, in about 25 days, a gain of 25 days on every voyage of the kind, and the relative gains on other longer or shorter voyages, require no further demonstration to show even the lay mind that the sailless ship has a very great advantage.

The original first cost of the full powered ship is greater than the auxiliary; the cost of operation is greater, but the gain in time; cargo carrying capacity; favorable insurance; demand for the vessel for time deliveries of cargo; ability to reach markets for certain acceptance of freights in competition with steam, certainly make a margin in favor of the full powered vessel, that will more than overcome the only thing which may be considered as at all favorable to the auxiliary sail ship, i. e. its smaller first cost.

So if you are going to use Diesel power at all, why not use a big strong robust engine of the type and take every advantage of its great economy, and not under power your ship merely to avoid the greater initial cost, for that seems to be the only valid reason for the use of sail and machine power, and other than this reason it seems incomprehensible, especially in view of the evolution in steam auxiliary vessels to full power, that the present growth of oil engines auxiliaries will continue.

Comparison of sail and auxiliary power vs. full power, using Diesel type engines in both examples, and assuming the vessel to be 240' in length b. p., 42' moulded beam and 18' moulded depth. Carrying 1,500,000 feet of lumber, and on a voyage Puget Sound to Honolulu and return. Auxiliary vessel will go, under full power, at 6 knots, under full sail, average, 6 knots, giving an average of 7½ knots using both together, alternately and separately; (in calculating this, it will be remembered that the engines are not to be run continuously or always in conjunction with the sails and that there is a considerable percentage of "drag" from the propellers, which would not be in evidence if vessel was under sail only; auxiliary vessel is barkentine rig.) The oil engines vessel will have 1,200 h. p. driving her at sea 11 knots per hour.

SOME DIFFERENCE.

Only three Diesel motorships have been changed to steam, but nearly a dozen steamers have been changed to Diesel propulsion, and when such motorships were converted there was no real bearing on the Diesel principle at direct issue. One was a case of under powering, another was faulty electrical transmission, and the third was due to lack of proper experience in designing certain parts. In the latter case, however, the ship had a loaded displacement of about 4,500 tons. After her conversion to steam engines and boilers we understand that the cargo-capacity of her holds was reduced by 410 tons and the daily fuel consumption increased from the original four tons to 15 tons; also firemen had to be employed where none were required before. Thus her earning powers greatly decreased, and her maintainance charges became higher. As it is her owners possibly are very embittered against the Diesel system of propulsion as they paid heavily for what seemingly was due to lack of discriminate reasoning in the early stages of the planning out of the vessel, and probably partly due to clever plausibility of some stationary Diesel engineers. As we pen these notes we remember that when this ship was under construction her owners maintained much secrecy about her entire installation instead of boldly coming out into the limelight, and thus giving others the benefits of their progress and at the same time gaining knowledge from the experiences of others. Unfortunately they failed to make public the real reason that the ship was converted to steam, thus inflicting another silent and undeserving blow on the marine Diesel engine.

PACIFIC SHIP BROKERAGE CO.
H. R. FREY, Manager
Cable Address "PACSHIPBRO" Portland, Ore.
EXCLUSIVE SHIP BROKERS
SPECIALTY WOODEN SHIPS
References: Lumberman's National Bank, Portland
BOX 342 PORTLAND, OREGON

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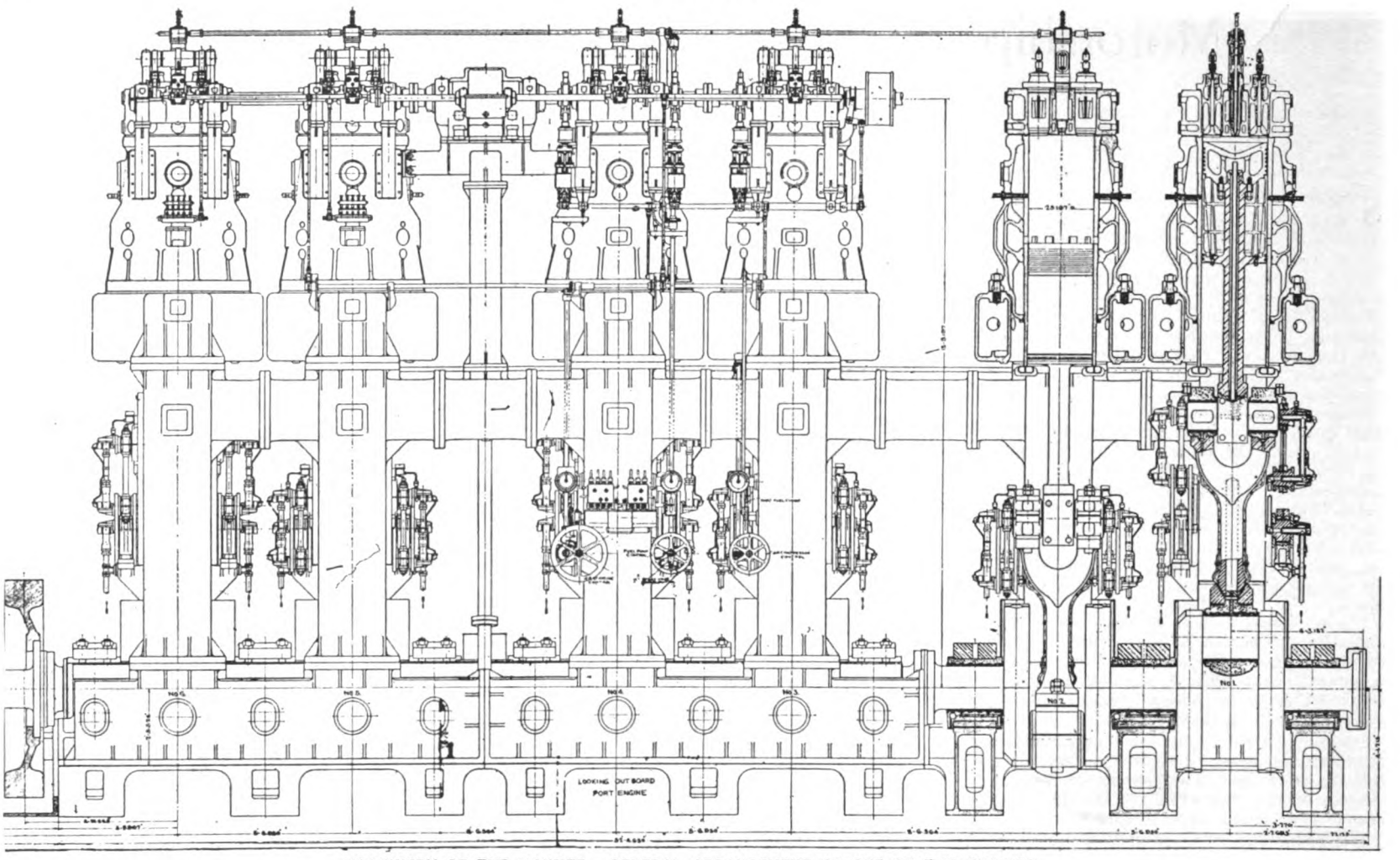


MACHINERY OF THE MAUMEE. GENERAL ARRANGEMENT OF ONE OF THE ENGINES.

The Naval Motor Tanker "Maumee"

An Interesting Discussion Concerning the World's Greatest Diesel-Driven Motorship

By T. ORCHARD LISLE.

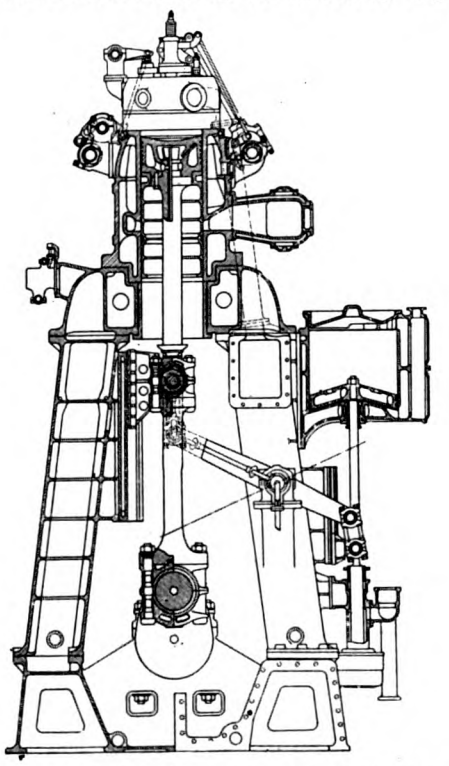
THERE is much that should be made clear about the emanation of the United States naval motortanker "Maumee," in order to prevent any misconception arising in the minds of shipowners. As is well-known there have been during the past few years some motorships that have been failures, and which have not increased the prestige of Diesel propulsion; but it is not the failure of these vessels that has been the principal bane of the marine Diesel engine development. It has been the absence of important knowledge concerning the construction of the machinery of such craft which has caused many American shipowners and shipbuilders to become impregnated with wrong impressions, thus making them view the general position from an entirely misconstrued aspect.

In several instances failures could well have been reasoned out and anticipated by some clear minded marine-engineers when the designs were completed and before construction was begun, but unfortunately those engaged upon such construction would not be guided by such experiences of others as were then available, but apparently preferred the risk of rushing blindly into the pits formed by their own rashness.

The motorship development, unlike that of steam, has been a sudden onslaught into the shipping world, and not a gradual evolution. In fact it has grown quicker than shipowners are willing to receive it. A dozen years ago a man who suggested building a 10,000-ton motorship would have been regarded as a ripe subject for the "bughouse." Yet today we have in commission the "Maumee," a Diesel motorship of 15,000 tons displacement.

Because of this extraordinarily rapid progress no branch of engineering ever has offered such wide latitude and open opportunities for making vital mistakes as has the Diesel engine industry in its application to the propulsion of large mercantile ships. Matters have been made even worse by such constructions having been handled by men who, while very excellent Diesel engineers in a specialized and in a general sense, had had little or no real experience of the requirements of mercantile sea-going conditions, so it seems were without the proper knowledge that since has been proved to be essential for the production of a reliable marine Diesel engine of high power.

Of course, it is obvious that "one must put a boy in the water before he can swim," but it hardly is advisable to throw him into deep water the first time he sees the ocean. Instead of advancing cautiously, and constructing graduated sizes and so accumulating the necessary experience while feeling their way in the dark, some of these European engineers urged by the possibilities that would result from success plunged boldly to building high powers at the outset and naturally ended in disaster or close to it.



Section of Secundus' Engine Showing Its Relationship with Those of the Maumee. Note the eccentric rods and rolling contact levers for operating the valves, which differs from cam and rocker system employed with Maumee's engines.

Let us quote an "improbable equivalent" of some of the mistakes made in Europe. If the manufacturer of a high-grade automobile were to design and commence constructing a 2,000 h. p. marine steam-engine and boilers without proper data or experience, any self-respecting shipowner would anticipate failure at the start; but would not condemn steam engines in general because of this individual case. Yet this is exactly the reverse to what shipowners have done with the Diesel motor. Just because a few motorships were constantly under repair they have condemned such vessels in general without probing into the remarkably unwise conditions under which the machineries of some ships were designed or built.

"There evidently is something rotten in the Kingdom of Kaloo," because here in the United States today there are more mercantile vessels under construction than ever before in the history of the country, yet there is not a single large full-power steel-built Diesel ship among them.* True, an order recently was placed for four wooden Diesel motorships of about 3,000 tons, but for foreign owners. True also it is that there are a very large number of motor-driven auxiliary sailing ships building, and four large full-powered so-called "semi-Diesel" ships have just been built and two of the latter purchased by American concerns. Also some small full-powered Diesel vessels have been ordered. Even in this latter case foreign enterprise and capital was responsible for their original construction.

What does it all portend?

Either domestic shipowners are asleep or else they are under a most serious misconception as to the real situation—most probably the latter. Hence the reason for this article on the "Maumee" taking these unusual lines, as we desire to

*NOTE.—Since the above was written William Cramp & Son's Ship & Engine Bldg. Co., of Philadelphia, have undertaken the construction of a full powered steel motorship and there is evidence that this blazing of the trail will stimulate similar construction in other quarters.

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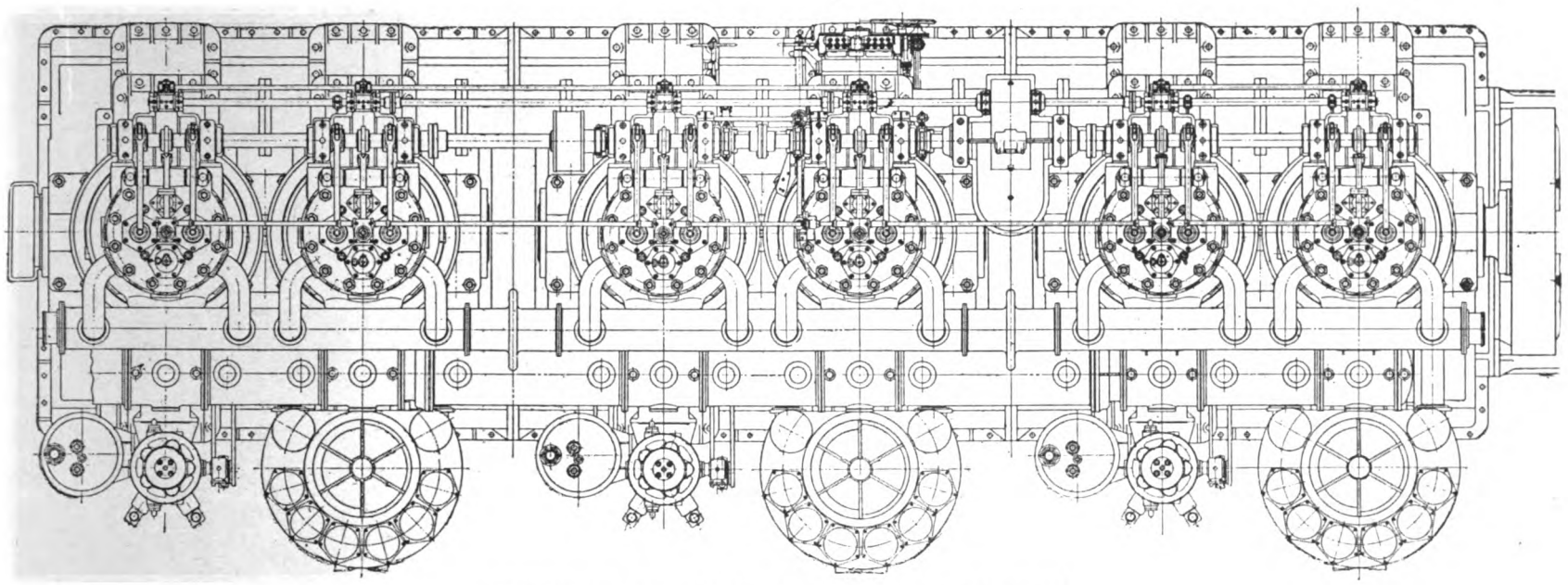


MACHINERY OF THE MAUMEE. PLAN OF ONE OF THE ENGINES.

avoid any such repetition of impressions so far as this particular ship is concerned.

This history of the "Maumee's" engines teaches a peculiar and important lesson, and the writer (who is a firm believer in the reliability and immediate future of the Diesel motorship) indicated to the naval authorities at Washington before the engines were completed that certain weaknesses were almost certain to develop, part of which unfortunately already has developed, and it is to be hoped, if the "Maumee" is not so successful as was expected, and as may be desired, that naval authorities or shipowners will not further be discouraged.

Let us say at the outset that the Brooklyn Navy Yard and its engineers really had to face a stupendous task and are to be congratulated at the splendid job they have made of the "Maumee's" engines, particularly as they have been laboring under far more severe conditions than those contended with by any of the European builders. They (the Navy Department) cannot have realized four years ago what an imposing task they had set for themselves!

In the first place the Navy engineers, we believe, had had no previous experience with the construction of mercantile-type Diesel engines. (We understand the experience of the engineer-in-charge previously was limited to submarine work and a visit to the European yards.)

Secondly, these engines are the largest and highest powered ever placed in a ship even to the present day.

Thirdly, they were designed by an inland foreign firm, who, at that time, had not installed a high-powered mercantile-marine Diesel engine in a ship, but who principally manufactured stationary Diesel engines, so apparently were without the proper sea-going Diesel experience that such big motors made imperative to have. Morally the designers had no right to dispose of such a design without first running a ship with engines of nearly similar power.

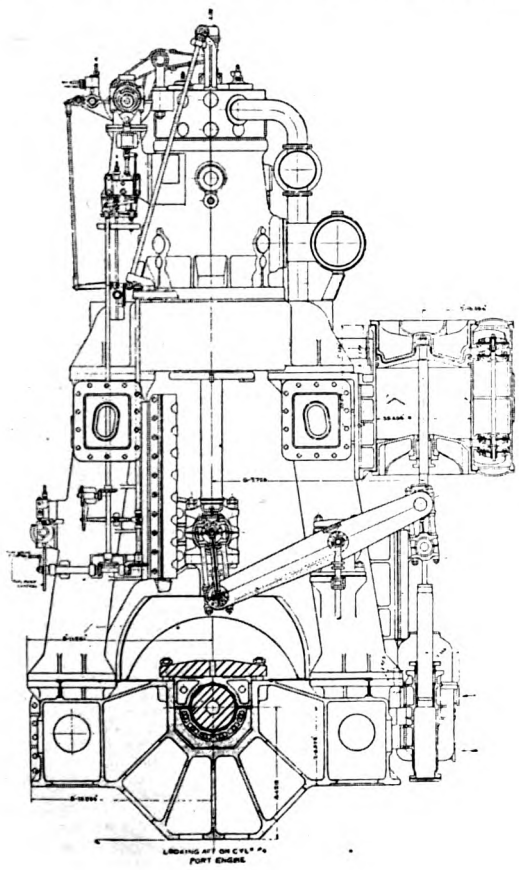
Fourthly, the "Maumee's" engines were designed about four years ago since when vast strides have been made in the design and construction of marine Diesel engines.

Fifthly, they are of the two-stroke cycle, the principle of operation of which produces very severe conditions for the constructors to contend with and overcome, far more so than with four-cycle engines. This only has properly been found out since the "Maumee's" engines were designed.

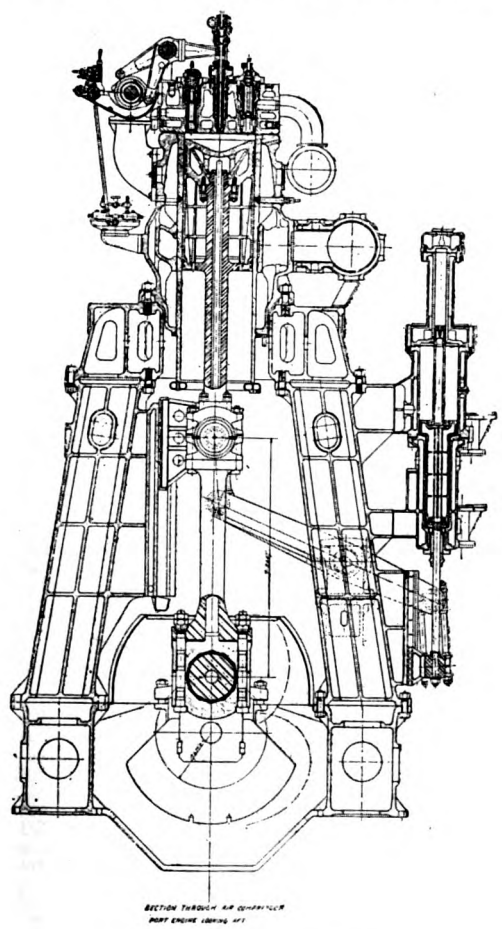
These five points will render comprehensive the enormous difficulties that faced the U. S. Naval Engineers right from the outset. For such results as have been obtained too much praise cannot be given, particularly to Lieut. C. W. Nimitz, who now is chief-engineer of the "Maumee," and who has been in charge of the constructional work throughout. He has made a splendid job, and it is to his untiring efforts that much is due. It was no small matter to have been given the world's highest powered engines to build as a first job.

When Congress made the appropriation for the "Maumee," little was known anywhere about high-powered marine Diesel engines, and it is later experiences with big motorships that has made apparent the lines along which the path should follow in order to obtain success.

However, a little wider inspection of the European yards might have been made at the time when the Navy Department sent engineers to study what then had been done, for several of the important marine Diesel builders were overlooked. At the same time it should be pointed out that at that time (four years ago) even the most success-

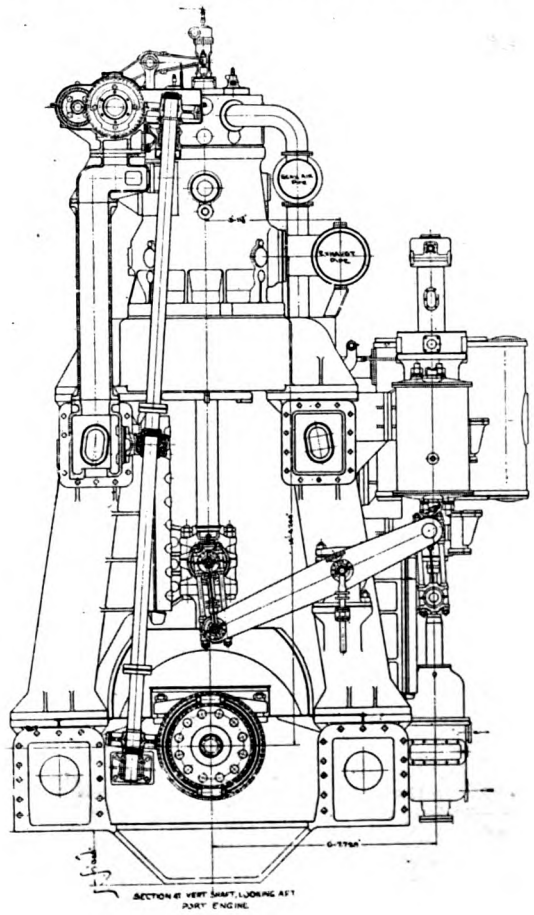


Section Through Scavenging Pump.



MACHINERY OF THE MAUMEE.

Sectional Arrangement Through Working Cylinders.



Sectional Arrangement.

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ful of the European engines were by no means perfect or absolutely reliable.

The British Admiralty made a similar mistake when they ordered eight Diesel-driven tankers, each about three-quarters of the power and size of the "Maumee." For, they purchased three untried makes of Diesel engines, and overlooked the two makes that since have proved the best of those in service. Also with one exception —the Vickers—two-cycle type engines were installed. In those days opinions often were partially formed by some of the "rubbishy" articles that appeared in the technical, semi-technical, and non-technical press intermingled witn occasional good editorials. The ill enects of such published matter can still be felt.

If the British naval authorities made such a mistake with facilities right at hand, the U. S. Navy Department can hardly be taken to task, because for them accurate information was more difficult to obtain.

Somewhere about the same time that the "Maumee's" engines were ordered the British Admiralty ordered a set of engines of similar design for a tank ship from the Nurnburg Works of the M. A. N. These two engines were six-clyinder sets of 1500 h. p. each, and except for very minor details are exactly the same design as the two U. S. A. Navy built engines of the "Maumee," and we reproduce herewith several illustrations of one of these engines. Where they differ from the "Maumee's" engines is in cases where improvements have been made by the Navy Department.

Where the Navy Department can be blamed, however, is for not having since ordered, or built, in addition a smaller tank-ship with engines of later design and of a different cycle, and along lines indicated by the most successful European practice; for, despite the proximity of war to their borders several neutral countries lately have made big strides in the development of motorships. In this manner the Navy Department could convince themselves, and American shipowners, that the Diesel engine can be built to form a successful and reliable system of propulsion for large ships, and that the Diesel principle is a practical one today.

Nevertheless, if the "Maumee" proves a success (as we hope) under sea-going conditions it will be a splendid thing for the motorship development; for, it will demonstrate that even under the difficult circumstances of construction the Diesel engine can be made reliable. But unfortunately we are inclined to believe that in this particular case weakness will develop if long voyages under full power are made, in which case the Navy Department should take into consideration all the foregoing fundamental facts and not condemn motorships in general. Instead, they should commence active construction along other lines.

Although the "Maumee" has been in commission for several months her sea-trials have not yet been run, the Navy Department wisely are taking every precaution to assure of good results, and are first giving the engines a thorough shakingdown. We understand that the results of the seatrials will be made public, and look forward to them with interest.

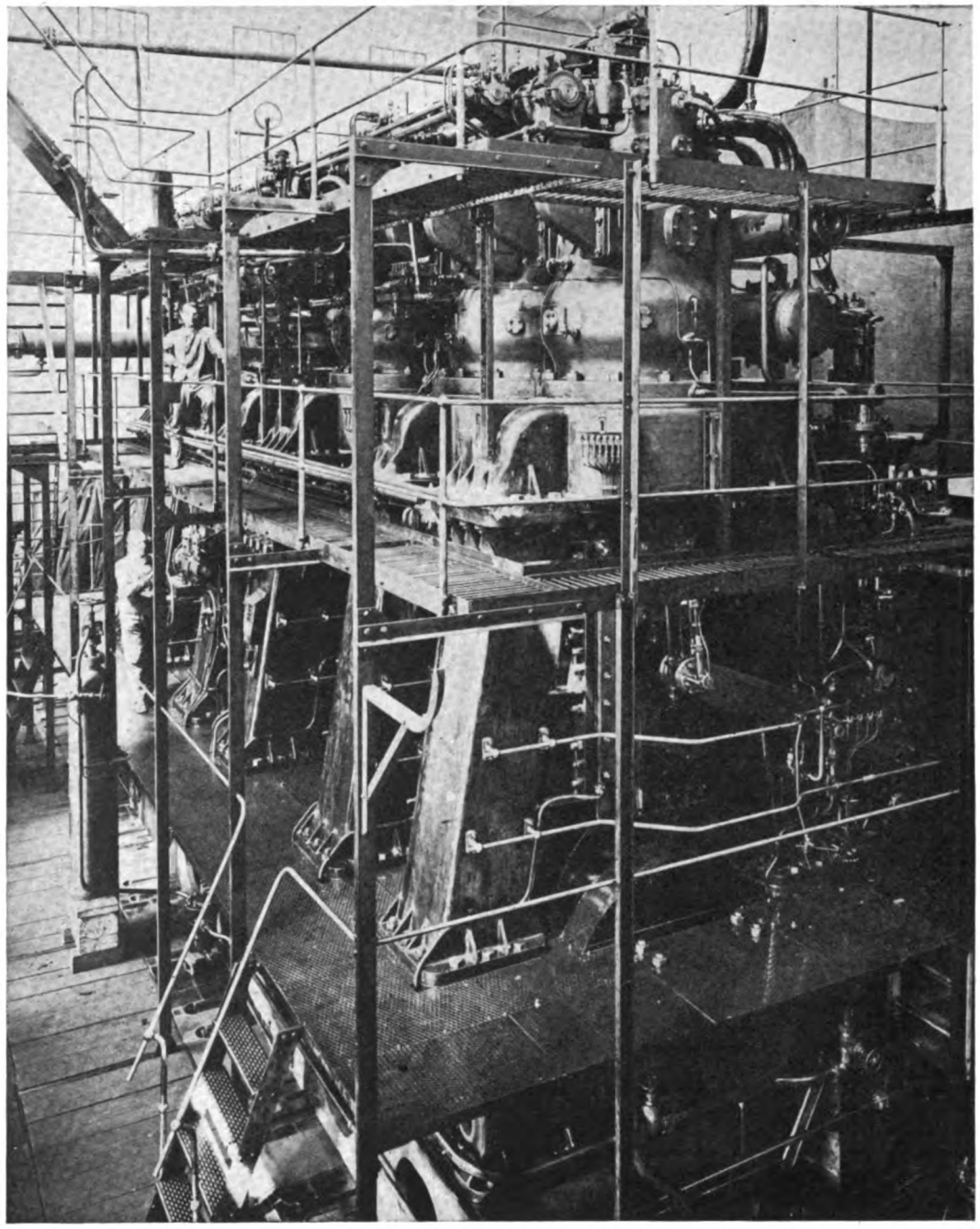
So far as can be ascertained from officially pub lished records the engines of the "Maumee," including a constructional license, etc., have cost about $120.00 per brake-horse-power to build; which, of course, is nigh, and would be high even with materials at today's prices; but the cost of the license, drawings, jigs, patterns and experimenting all had to be borne by these two engines. The advantages of standardization of parts, such as a private manufacturer would have, is practically lost when only two engines have to be built. This partly accounts for the high cost.

The appropriation was made for the "Maumee" and the "Kanawha," a sister steam-driven tanker, in August, 1912, each to cost $1,140,000.00, and for the "Maumee" some unobligated balances from previous appropriations to the extent of $250,000.00 were also used. The two hulls were built at Mare Island Navy Yard, San Francisco, and that of the "Maumee" was towed with a cargo of oil to Brooklyn, via the Panama Canal, where the engines were installed, and the "Maumee" went into commission in November, last.

She is 455 feet long b. p., with 56 feet breadth of beam and 26 feet draught on a loaded displacement of 15,000 tons, and with the engines developing the equivalent to 5,200 steam indicated-horse-power in aggregate, she should have a speed of about 14½ knots. The equivalent to 5,200 steam indicated-horse-power would be obtained we estimate with each Diesel engine developing about 2,300 b. h. p. (shaft horse-power).

In checking this article the Navy Department pointed out that the speed of 14½ knots should be obtained with the engines developing 5,000 shaft-horse-power.

As indicated the figures in the foregoing paragraph are the author's estimate and are not official.



ONE OF THE 1500 H. P. "M. A. N." ENGINES BUILT FOR A BRITISH NAVAL TANKER, SHOWING PIPING AND GRATING IN POSITION. THIS ENGINE IS SIMILAR IN DESIGN TO THE 2500 B. H. P. ENGINES IN THE MAUMEE.

Now the "Maumee's" engines are designed to each develop 2,500 b. h. p. (about 3,400 i. h. p.) at 130 r. p. m., and seeing that as high as 3,050 b. h. p. (8,000 i. h. p. in aggregate) was developed from one engine alone on the shop trials at 140 r. p. m., the designed sea-speed should easily be attained with the motors running at considerably less than maximum load. The engines of the "Kanawha" are designed to develop together 5,200 i. h. p. or about 2,300 b. h. p. each, and also to give the ship a speed of 14½ knots when loaded. So evidently there will be no necessity to "force" the engines of the "Maumee" unless the Navy Department desire to ascertain the maximum strain that they can stand. In fact the designed speed should be attained with the engine at about seven-eighths load.

The mean-effective-pressure, at designed load is 96 lbs. The mechanical-efficiency somewhere between 60% to 72% compared with 80% to 84% for four-cycle engines. On the test-bed the average fuel consumption was 0.50 lbs. per b. h. p. hour, but this may be bettered in the ship where the exhaust pipes are quite short compared with the 70 ft. pipes used in the erecting-shop.

At this point we think we are justified in criticizing one feature of the design. We consider the designed full-power speed much too high for engines of this size and certainly should not exceed 100 r. p. m. The six cylinders are 25.3 inches in diameter by 39.37 inches stroke, which, by the way, means that the center of heat in the cylinders is about 12½ inches away from the water-cooled walls of the cylinders; and, as a combustion occurs each revolution, we estimate that the mean indicated temperature in all the cylinders, when the engines are developing full load, is somewhere around 1150-1200 degrees Fahr. On this point we should like to have the Navy Department's records. Such a heat condition, in conjunction with the internal strain, is likely tc give rise to frequent cylinder cracks, especially after the motors have been operating for a prolonged period, when the metal seems to become "tired," or else its molecules assume some new form.

No four-cycle type Diesel engines of this power have been built, but such engines with as large cylinder dimensions have been placed in service, only at slower revolutions, and unless our information is at fault the mean indicated-temperature has been about 600-700 degrees Fahr. when at full load, which is vastly different from the abnormal continuous temperatures that we estimate the "Maumee's" motors have to contend with. If the "Maumee's" engines are run at reduced load the m. i. t. may not exceed 1,000 degrees Fahr., or perhaps a little less. This piston speed is 4.35 meters per second, which is higher than most other leading mercantile-type Diesel engines.

Our remarks on the speed are borne out by the actions of Blohm & Voss, the famous German shipbuilders and engineers, who, just before the outbreak of war placed in service the "Secundus," a ship fitted with two motors of similar design to those in the "Maumee," but of smaller size, being 1,350 b. h. p. each. Now, the cylinder dimensions were 23 6-10 ins. by 36 2-10 ins. stroke, and were only designed to run at 120 r. p. m. when at full load. The fuel consumption was a little better than that of the "Maumee," being 0.425 per b. h. p. hour; also the efficiency was higher, being 75%. The i. h. p. per shaft was 1,800, so that the fuel consumption per i. h. p. hour was 0.32 lbs. The mean-indicated-pressure both in the ship and on the test-bed was 97 lbs. per sq. inch.

Perhaps we should explain here that Blohm & Voss took up Diesel engine construction in conjunction with the Nurnberg works of the M. A. N It was the same branch of the M. A. N. that designed the two engines of the "Maumee," but it was at the Augsburg works of the M. A. N. that the late Dr. Diesel invented and produced the first Diesel engines in co-operation with Herr Lauster (the Chief Engineer at Augsburg) and in co-operation with Fried. Krupp of Kiel-Gaarden. Incidentally we may mention that Lauster and the Augsburg Works have been consistent advocates of the four-cycle Diesel principle whereas the Nurnburg Works and Krupps have chiefly favored the two-cycle system.

It was hoped that the special construction adopted with the cylinder heads of the "Maumee's" engines would have prevented cracks; but this anticipation has not been altogether realized. The Navy Department based their latest design of cylinder heads upon Blohm & Voss construction, but with a little difference. The heads of the cylinders of the "Maumee" engines are in two parts, the upper (main) section being of cast-iron, while the lower part is a steel forging hollowed-out for water-cooling, and in the event of this cracking it can be replaced at less cost than an entire head. We understand that built-up steel pieces also were used. But even this design does not appear to have formed a satisfactory solution of the problem. Possibly such cylinder head troubles as have occurred had nothing to do with the design, and may have been flaws in the metal, hence our contention that it is best to always make clear causes of mishaps of this nature.

With the Blohm & Voss engines of the "Secundus" the cylinders also had composite heads, comprising an inner water-cooled shallow drum-shaped piece and an outer unjacketed casting in the nature of a keeper. This enabled the builders to use at the crown of the combustion chamber a quality of cast-iron selected principally for its capacity to resist the effects of sudden extreme changes of temperature. Various grades of cast-iron were tried and even bronze, but the U. S. Navy Department was the first to use steel. We have not calculated the strain to which the cylinders of the "Maumee's" engines are normally subjected to; but with the smaller cylin-

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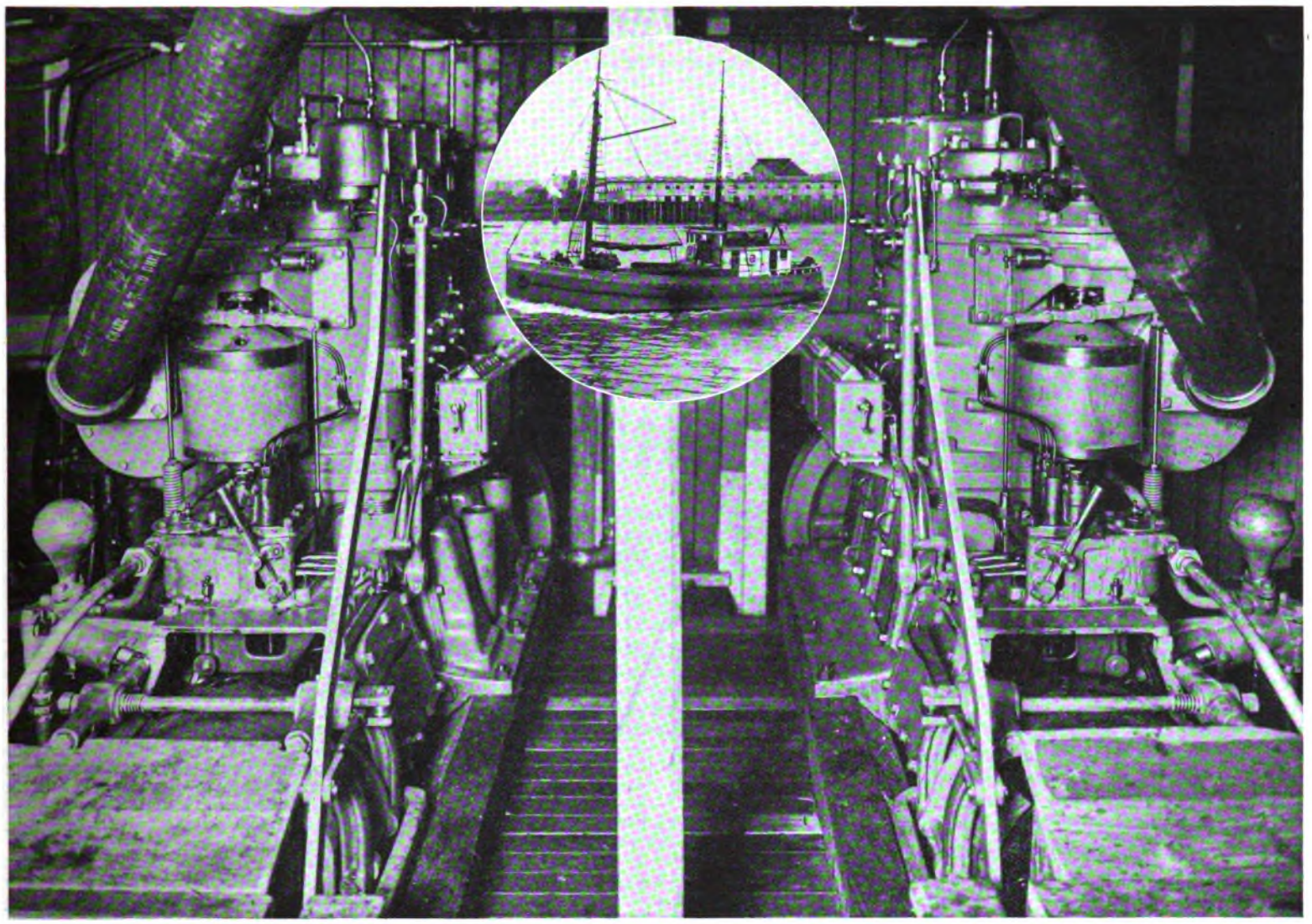

NEW OIL ENGINES FOR SMALL GENERAL CARRIER.

The photographs reproduced above show a general view and the engine room of the motor freighter Roamer, owned by Peter Olson, of Marshfield, Ore., which has been overhauled and equipped with a complete new power plant, which has not only increased her speed materially, but has greatly reduced her cost of operation. The Roamer is a 64½-ft. boat, with a beam of 20 ft., and a draft of 8 ft., loaded, the hold being 7 ft. deep. The former power plant, a 75 h.-p. distillate engine, was replaced by a pair of twin 45 h.-p. Fairbanks-Morse surface-ignition oil engines, driving 38 by 36 wheels at 400 r. p. m.. The new equipment gives the Roamer a speed of 10½ to 11 miles per hour, an improvement of about 2 miles over the former installation. Besides the main power plant, she has been equipped with a 4 h.-p. Fairbanks-Morse distillate hoisting engine, and a 3 h.-p. oil engine direct connected with a 1¼ KW electric generator. The cost of operating the entire power equipment has been cut to approximately half what it was formerly.

ders of the "Secundus'" motors the force borne by each crown is about 115 tons.

Another advantage of the B. & V. composite design is that the inner cover is a fairly simple casting that can be produced reasonably free from original internal stresses, and thus should be better prepared to resist the stresses imposed upon it when in service. Also its lower surface should be less liable to fissures than the integral type of cover where the contraction stresses of a complicated casting have to be met apart from the stresses pertaining to the operation of the engine.

From a theoretical aspect it may be considered that, where detachable covers are adopted, composite heads are superior to integral heads, and so the U. S. Navy engineers, being unable to make radical changes, without widely departing from the original drawings, have been correct in following the footsteps of Blohm & Voss. The latter company, and the Augsburg Works, have shown themselves to be the most cautious, conservative and thorough Diesel-engine builders and designers in Germany. In a way it is unfortunate that the Navy Department did not go to Blohm & Voss for the drawings, because this company essentially are marine engineers and are familiar with marine requirements.

The pistons of the "Maumee's" engines also are in two parts, namely the working piston, which consists of an iron casting cored for water-cooling and ribbed for strength, and a lower casting that is bolted to the piston rod. These two parts are not bolted to each other, but both are secured to the piston-rod.

Fresh water is used for piston-cooling, and for its intake and outlet the piston-rod is drilled hollow, and fitted with a central steel pipe to take the incoming flow and a concentric passage around this pipe forms the outlet. The water coming up the central pipe via knuckle-joints enters the central compartment of the working piston, passes out towards the sides through the cored passages, and eventually reaches the concentric space in the piston-rod via four pipes set on angles of about 45 degrees from the highest points of the water space, ensuring a flow of water along the hottest parts of the piston.

Mounted adjacent to the cylinder head on the front of the engine is the cam-shaft that operates the valve-rockers and valves, and this cam-shaft is actuated by means of a vertical rod and gearing from the crank-shaft and turns at the same speed. There are three cams for each cylinder; two for the scavenging-valves and one for the fuel-injection valves, and the same set of cams is used for both ahead and astern motions. This is accomplished by not keying the camshaft driving gear to the shaft; but to the gear is secured the male part of a two-jaw clutch, while the cam-shaft carries the female jaws of the clutch, these being 35 degrees wider than the male jaws.

Assume that the engine is running ahead and it is desired to reverse. First the fuel and injection-air are cut off, and compressed-air from the starting-reservoirs is admitted to the cylinders whose cranks are in the correct position for starting in the reverse direction. Now, the crank-shaft moves through the 35 degrees just referred to before the cam-shaft starts to turn, which brings the cams in the proper position for running astern. Then the fuel and injector-air are automatically turned on, and the engine picks up speed under load, the entire operation not taking more than 10 or 12 seconds.

Bolted to the side of the cam-shaft gear is a smaller gear, which drives the starting-shaft, just inboard of the camshaft. As the camshaft gear turns at the same speed (but opposite in direction) as the crank-shaft, so the starting-shaft turns in the same direction as the crank-shaft, but always with it. This shaft is mounted in bearings held in the camshaft casings, and carries three cams directly underneath a distribution block for each cylinder. One cam operates a poppet-valve in the distribution block for ahead motion, one cam operates for astern motion, while the middle cam serves to vent the air-piping which opens the starting-valve. The distribution-blocks serve to open the starting-valves on the cylinders at the proper time.

As the engine commences to turn, the cams on the starting-shaft, through the distribution blocks, hold open each cylinder air-starting valve from 10 degrees past top-center to 85 degrees past top-center, when the distribution blocks are rendered inoperative by the maneuvering control-wheel. Cams on the disengaging shaft operate on bell-crank levers under the distribution-blocks, and the outboard ends contain rollers, which transmit the motion of the starting-shaft cams to the poppet valves in the distribution blocks. When the engine is running normally the cams on the disengaging shaft hold the rollers clear of the starting shaft cams.

Blohm & Voss with their engines introduced several features not contained in the Nurnburg designs. For instance they employed eccentric-rods and rolling contact-levers for the actuation of the valves in the cylinder head. This system is more costly to construct than the cam-and-rocker-gear used with the "Maumee" engines, but it is much quieter in action generally, and gives a distinctive character to the motor. Blohm & Voss always have displayed an utter disregard of expense and have not hesitated to "scrap" an entire engine and start afresh.

With most two-cycle type engines lubrication of the main-bearings, crank-pins and top-ends has been a most worrying problem, because of the constant pressure to which the lower halves of the brasses are subjected, there at no time being any relief, and any water or carbon deposit from the pistons getting into the oil aggravates this. But so far as we can ascertain there has been no important bearing trouble with the "Maumee's" motors, which indeed is pleasant news, so details of the arrangements form interesting reading.

In the case of the motorship "Abelia" the pressure on the brasses of the crank-pins is about ¾ ton per square-inch of bearing surface, or to be exact 1,556 lbs. per sq. inch. The "Abelia" was a twin-screw two-cycle Diesel vessel of 1600 total b. h. p. To give a comparison the pressure on the crank-pins of the "Sebastian's" engines is 630 lbs. per sq. inch. The "Sebastian" is a vessel equipped with two 825 b. h. p. four-cycle Diesel engines. This would indicate that the pressures to be contended with may easily vary 300 per cent with different designs and cycles, and shows how care has to be taken in designing the bearings. It further indicates that pressure conditions are far greater with the two-cycle type, and that much greater surface is needed in consequence.

The 16½ in. diameter crankshaft of the "Maumee's" engines each are in three sections (forged by the Erie Forge Co., of Erie, Pa.). It has a tensile strength of 71,000 to 78,000 lbs. per square inch, with 18 to 20% elongation, while the test-bar was bent around an angle of 180 degrees. Its sections are hollowed, being drilled with a five-inch hole for the forced-lubricating system, the oil entering the main-bearing journals from the lower main-bearings. The sequence of the cranks turning outward is 6, 1, 4, 5, 2 and 3.

In order to accommodate the pressure the bearing-brasess are lined with a white-metal of the following composition tin, 80%; antimony, 15%, and copper 5%, which is rather harder than the Naval standard. The center main-bearing of each of the two sections of the bedplate is 20 inches long, while the others are 16½ inches over all. Each consists of a flat-bottomed cast-iron seat, a lower main bearing-brass, cored for water-cooling, a flat-topped upper brass, cored for stiffness and lightness, and a forged-steel binding-cap, secured by four steel studs. The low-pressure oiling system feeds these bearings; a pump sucks from a well in the engine crank-pit and discharges through a strainer and a cooler to the main supply pipe, whence a feed-pipe leads to the underside of each main bearing, and the over-supply is carried right through holes drilled in the crank-pins to the crank-pin bearings, thence to the lower bearing of each crosshead brass.

The drawings give a better general idea of the engine than a description, and it is only incidental features such as we have dealt with that need a detailed description.

The engine—one description applies to the other, except that they turn clockwise, and counter-clockwise, respectively—is of the open crank-pit type with cast-iron A-frames mounted on a heavy cast-iron bed-plate. These frames carry the cylinder-jackets, which, as previously mentioned, have detachable heads, while the combustion-chamber is formed by a special cast-iron liner pressed into position, and, as this is machined inside and outside, the expansion and contraction should be very even.

For scavenging out the exhaust-gases from the combustion-chamber large double-acting air pumps—three in number—are mounted on the back of the engine, and are operated off the crosshead by rocking-levers. The air is admitted through two valves in each cylinder-head, and passes out through ports at the bottom of the cylinder, at the same time driving out the exhaust gases. This system is more effective than simple port scavenging, but some engineers say that it will be abandoned in the near future in order to reduce the number of valves in the cylinder-head near where the heat stresses are the greatest. Here it may be pointed out that in actual practice the number of valves in the cylinder-head have little to do with cracks developing. Four good openings in the head give better results than one badly designed orifice.

Although crosshead and guides are fitted, the pistons are of the "long" type, which is necessary because of opening and closing the ports, for the latter must be closed when the piston is at the top of the stroke. Finally we may remark that all the auxiliary machinery is operated by steam from an oil-fired boiler, the exhaust gases from the main Diesels not having been utilized for that purpose. When the sea-trials of the "Maumee" have been run we hope to be in the position to give details.

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A VOTE OF CONFIDENCE.

An announcement of striking significance appears on another page of this issue, which will come as a severe blow to the scoffers of large Diesel-driven motorships. We refer to the ordering, with the largest shipbuilders in the British Isles, of four 13,000 tons motorships of 13 knots speed. Harland & Wolff, the builders in question, are too conservative to attempt such a task unless they were fully confident of successful results. Also they now have built sufficient number of large motorships to be perfectly aware of the importance of the steps they are taking. If they were not absolutely sure of success they easily could install steam and not take any risks with motors. Their action, however, is a most remarkable answer to the disbelievers in the reliability of the modern Diesel motorship.

European shipowners are placing orders for large Diesel-driven motorships as rapidly as they can get them built. What's that our believe only-in-steam-friend remarked?—"Won't pay them!" No! that's why they are doing it; awfully reckless fellows these old-established foreign shipping companies!

IMPRESSIONS OF SHIPOWNERS.

Elsewhere in this issue we have had occasion to refer to the impressions many shipowners have accumulated regarding the reliability of motorships, and in connection thereof we quote the following extract from a letter recently sent us by prominent lumber concern who in their business use a number of ships:

> "We are having some very discouraging news in regard to the large Diesel engines. Engineers have reported to us that scarcely any of these larger engines have 'made good', so to speak, that they are continually out of order, and it is almost impossible to get engineers who can run them. We understand the Standard Oil Co. is dissatisfied and very much disappointed in the ships which they have. We, however, believe that a smaller engine up to 100 h. p. is a success, and we are anxious to try them out in small ships. We are thinking of placing an order for two or three ships of this kind. While we have had these discouraging reports, our people would be willing to take a chance and also purchase a ship of 2,500 tons or thereabouts, if it was ready and could be bought as we say above, within reason."

Here evidently is a case where engineers have sent in unfavorable reports, which reminds us that we know of at least one prominent naval-architect and consulting-marine-engineer, very much respected in the steamship business, who has no faith in, or use for, large motorships, and does not hesitate to condemn them. Unfortunately, this engineer went on board some of the earlier Diesel vessels, which due to reasons also given elsewhere in this and previous issues of Motorship, suffered from many mishaps, and evidently he based his opinions accordingly. Consequently many successful motorships now enter the local port every week, but are not favored with his inspection.

REMARKABLE FACTS ABOUT THE EAST ASIATIC COMPANY'S REPORT.

THE reports covering the last four years' operations of the East Asiatic company, which we printed in full last month, should be minutely studied by every American ship owner for some remarkable facts are portrayed therein.

One thing prominently borne out is, either the big Diesel motorship is a proven success, or else this company's reports to their stockholders are false, misleading and ridiculous. Judging by the splendid financial results there cannot be the slightest doubt but that their motorships are a success in every way including mechanical and commercial aspects, and that the report of the East Asiatic company is perfectly sound and accurate.

We give below several extracts from the report which are worthy of special prominence and repetition (although the complete report was given last month) because we realize that American ship-owners interested in foreign trade will be forced to adopt motorships on similar lines if they desire to successfully compete with the East Asiatic company.

"The company's motorships have worked satisfactorily in every respect, amply fulfilling the hopes expressed in the appendix to the two last yearly reports, and they have realized considerably larger net profit, as compared with the steamers."

"In accordance with the company's general principles, viz., as far as possible to maintain its fleet on a level with modern developments, it was decided in future principally to employ motorships on the overseas routes."

"About the middle of the year the company decided to dispose of all its steamers."

"The confidence placed in this new motor propulsion as set out in the reports for 1910 to 1914 has not been shaken."

"In view of the success of Diesel motors the company has decided to build, etc."

"The experience gained by the performances of these vessels came up to expectations. The motors worked satisfactorily in the different weathers and climates."

"Savings derived from the consumption of oil as compared with that of coal, and the increased earnings from freight owing to the comparatively larger carrying capacity of the motorships, fulfilled expectations."

"The Diesel marine engine has less internal working parts and is therefore less complicated than a marine steam engine."

"Working parts of the Diesel marine engines have as long a life as those of the marine steam engine, and also that repairs and renewals to its working parts will not exceed those to the corresponding parts of the steam engine."

When reflecting upon the statements above, it is well to remember that no ship owner's company knows better than the East Asiatic company whether, or not, motorships are really preferable to steamers, for up to December 31, 1915, they had in service 16 big Diesel-motor driven vessels aggregating 114,611 tons d. w. c., and of a total power of 39,860 i. h. p.

In view of the above it certainly seems extraordinary that there exists today dozens of ship owners in the United States who apparently are afraid to take what they term "the risk" of ordering motorships. Are we to remain rubes or do we intend to have the greatest mercantile navy in the world? If the latter our sole hope lies with developing and building motorships.

A CASE FOR AUXILIARY POWER.

Seeing that the last message of the American 2,214 tons four-masted steel bark "Manga Reva" was

> "Come quickly as possible. Am drifting before the wind with no boats."

It seems that she could have been saved had she been equipped with auxiliary motor-power. She represented an investment of $300,000. We suggest to her owners, the Brynhilda Shipping Corporation, that they install an auxiliary oil engine into the next sailing ship they buy.

A SUGGESTION FOR AN EFFICIENT SUBMARINE PATROL.

(Contributed.)

About seven years ago the British Admiralty planned-out a scheme for placing swarms of motorboats in patrol and despatch services around the coasts. Then the whole matter was pigeonholed, and the reports and recommendations lay dust-covered until the present submarine menace started, which made some form of patrol an urgent necessity.

The old documents were hauled out, doctored up, alterations made, and a fleet of 500 seventy-six feet and eight-six gasoline driven boats were ordered in one lump. As a result of this hasty action the Admiralty found themselves burdened with a swarm of craft which were far too small and their cruising radius too limited, to render them adequate for the purpose required. Such a mistake easily could have been avoided had a few experimental boats of different sizes and speeds been built when the scheme first was conceived.

It looks as though this country will be caught "napping" in a similar manner, for so far only two very small patrol motorboats have been ordered by the Navy Department. Recently the Navy professed interest in the well-meaning and enthusiastic attempts of a number of power yatchsmen to build at great expense to themselves a number of yachts along the lines of submarine chasers.

But it is time that the Navy Department awoke to the fact that such manoeuvres are but child's play compared with the grim task of searching for enemy submarines under actual war conditions, day after day, month after month, with but few intervals for rest. Many of the boats built by private owners, also the two building for the U. S. Navy, would be useless 40 or 50 miles off shore in really bad weather—and submarines now have learned to operate in deep water, and not to venture in close to land. Imagine the terrible hardships of staying one to two weeks at a time (and keeping it up for a year or more) in a sixty-foot motorboat built for speed. Neither the men nor the boats could stand such severe service.

To successfully cope with a possible submarine menace America must have vessels that can do this work under these conditions, and we would do well to profit by the lesson taught by the expensive experiences of the British naval authorities. T. B. Destroyers are too expensive to construct in sufficient numbers to properly undertake the duty, (also they are required for other purposes) and gasoline boats are too small. Hence a new class of vessel must be evolved.

The writer strongly advises Diesel crude-oil engined vessels steel-built along the lines of torpedo-boats, but smaller, not quite so fine lined and a little stronger in proportion to their size. Several sizes between 120 feet and 160 feet could be tried, but about 135 feet would seem to be the most practical. A couple of light guns and one torpedo-tube could be carried as armament, but no armor would protect the hulls.

Two submarine-type four-cycle Diesel internal combustion engines, each of 800 b. h. p. at 300-400 r. p. m., would be installed as propelling power, and two Diesel engines of about 30 b. h. p. each for auxiliary purposes. With this power about 20 knots should be obtained, as the main engines should not together weigh more than 30 tons in aggregate.

At full speed, which would be sufficient for all purposes, the main engines would use six tons of oil fuel per day, but most cruising would be done with one motor at three-quarter power, so that under ordinary circumstances 20 tons of fuel would last about a week or 2,000 miles at 12 knots, including for auxiliary purposes. A regular fuel tankship service could be maintained for fueling these little vessels by means of Diesel driven tankers of about 1,500 tons capacity, and about 14 knots speed.

A patrol service of vessels of this power and size would be thoroughly practical, and would be capable of standing the severe conditions of prolonged sea service, yet furnishing a reasonable amount of comfort to the officers and crew. Something along these lines should be started without delay, or if war does come it will find us unprepared.

OPENING ON MOTORSHIP STAFF.

There is a good opportunity for a young man with technical training to become permanently attached to the editorial department of Motorship, Seattle office. Must have a taste for work of this character.

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LEADING MAKES OF EUROPEAN MARINE CRUDE-OIL ENGINES

Make of Diesel Engine—	B. H. P.	I. H. P., Approx.	Equiv. Steam, I. H. P.	Revs. per Min.	No. of Cyls.	Bore	Stroke	Weight, Tons	Length	Height Above Shaft	Width	Piston Speed per Minute	Mean Ind. Pressure per Sq. Inch, Lbs.	Type	Efficiency	Fuel Consumption per 24 hr. day (Approx.), Tons
Blohm & Voss (M. A. N.)	1350	1800	1600	120	Four	23 6/10″	36 2/10″	.....	.....	.....	.....	724′	97	2 cycle	70%	6 1/3
Swan Hunter & Wigham Richardson (Neptune Polar)	650	850	800	130	Four	16 9/64″	31 55/64″	.....	16′ 0″	20′ 0″	.....	690′	102	2 cycle	78%	3 1/3
Polar	825	1100	1000	165	Six	17 7/10″	21 3/10″	70	22′ 6″	14′ 0″	.....	585′	.....	2 cycle	.....	4
Polar	1650	2300	2000	120	Six	23⅝″	35 7/16″	.....	.....	.....	.....	708′	.....	2 cycle	.....	9
Werkspoor	825	1100	1000	130	Six	20½″	35½″	96	25′ 3″	15′ 7″	8′ 0½″	769′	90	4 cycle	82%	3
Werkspoor	1500	2000	1800	110	Six	26″	47¼″	190	34′ 0″	19′ 6″	10′ 0″	866′	90	4 cycle	82%	6½
Krupp	1200	.....	1450	135	Six	18 9/10″	31½″	140	.....	.....	.....	735′	100	2 cycle	.....	6
Sulzer	850	1000	1000	160	Four	18½″	26 8/10″	*55	22′ 8″	15′ 0″	8′ 4″	714′	.....	2 cycle	.....	4
Weser (Junkers)	1000	.....	1300	120	Three	15 7/10″	15 7/10″	.....	23′ 6″	26′ 0″	9′ 0″	314′	.....	2 cycle	.....	4 8/10
Frerichs (Junkers)	850	1100	1020	185	Three	18 3/10″	20½″	.....	.....	.....	.....	615′	124	2 cycle	74%	4 1/10
Tecklenberg (Carels)	1500	2200	1850	120	Six	.....	.....	200	.....	.....	.....	.....	108	2 cycle	.....	8
Reiherstieg (Carels)	1650	2300	2000	90	Six	23⅝″	43¼″	300	46′ 0″	22′ 0″	17′ 0″	648′	90	2 cycle	72%	9
Schneider (Carels)	900	.....	.....	230	Four	17 6/10″	22″	.....	23′ 0″	10′ 0″	.....	843′	100	2 cycle	.....	4¾
Carels	1600	2300	1980	130	Six	20 1/10″	36 2/10″	.....	.....	.....	.....	784′	.....	2 cycle	70%	8½
Burmeister & Wain (England)	1100	1475	1300	130	Six	24 8/10″	33 4/10″	.....	.....	.....	.....	723′	.....	4 cycle	74%	4
Burmeister & Wain (Copenhagen)	1650	2000	1900	100	Six	29 9/64″	43 5/16″	.....	.....	20′ 0″	9′ 9″	720′	.....	4 cycle	82%	7¾
U. S. Navy (M. A. N.)	2500	3400	2800	130	Six	25 3/10″	39 37/100″	.....	41′ 6″	21′ 7½′	15′ 4″	853′	96	2 cycle	74%	13 1/3
F. I. A. T.	2200	3200	3075	130	Six	24 8/10″	35 4/10″	.....	.....	16′ 0″	.....	767′	.....	2 cycle	.....	10½
Bolinders (surface-ignition)	550	.....	650	160	Four	22″	29″	48	27′ 0″	10′ 3″	.....	785′	.....	2 cycle	.....	3¼

*Without a 9½-tons flywheel.

We give above some data concerning the leading makes of marine crude-oil engines of high power suitable for the propulsion of large merchant vessels, which will be of great value to shipowners, shipbuilders and naval-architects when planning out designs of freight and tank motorships. While every care has been taken to ensure accuracy we have been unable to verify any of the above figures owing to war conditions now existing in Europe. In all the above instances the engines are of the true Diesel-type with one exception, namely, the Bolinders, which is of the surface-ignition, or hot-bulb, class.

The Weser-Junkers engine is of the opposed piston tandem type, having twelve pistons, so is nearly equivalent to six double acting cylinders. The Frerichs-Junkers engine has six opposed pistons, is about equivalent to three double-acting cylinders. All the other engines are single-acting.

NEW CONTRACTS PLACED AT PORTLAND.

Gaston, Williams & Wigmore, of New York, have just closed a contract for the construction of two full-powered motorships with the new shipbuilding firm of Supple, Ballin & Lockwood, of Portland, Ore. The vessels will be built on the double diagonal system, with steel top sides for longitudinal reinforcement, and will be of the forecastle and long poop type, with machinery well aft. They will have three masts and three hatches; four booms on the main mast and two each on fore and mizzen masts; and the masts will be rigged for a limited spread of sail, the motors being relied on almost entirely for propulsion. The hulls will be built with full 'tween-deck space.

The boats will have a keel length of 285 ft., and will be slightly over 300 ft. long overall, with an extreme breadth of 44 ft., and a moulded depth of 26 ft. The deadweight capacity will be about 4,000 tons; the gross tonnage about 2,050, American. Each vessel will have a propelling power of 1,000 b. h. p., consisting of twin 500 h. p. Winton true Diesel type oil engines.

Supple, Ballin & Lockwood, the builders, have just formed a partnership, the members of which are Joseph Supple, Fred A. Ballin and J. B. C. Lockwood, all of whom are well known in marine affairs of the Pacific coast. Mr. Ballin returned from New York with the signed contract early in the month, and work was immediately started on ways for the new ships beside the Morrison and Burnside bridge, Portland, on the east side of the river.

NEWS OF SOUTHWARK-HARRIS PACIFIC INSTALLATIONS.

Secretary C. C. Kriemler, of the Standard Gas Engine company, has been in Seattle for the last ten days making arrangements for the installation of the two 625 h. p. Southwark-Harris Diesel type motors in the new motorship under construction for the Alaska Pacific Navigation company. This will be the largest commercial marine Diesel installation yet made on the Pacific coast. The engines are of the 4-cylinder type, 2 cycle, directly reversible. They operate at a speed of 200 revolutions per minute, and use the step piston for direct reversing.

The working piston is the operative force only when fuel is feeding into the cylinder chamber, and all work of starting and reversing is done by the lower or scavenging piston, which is so arranged as to become an air motor for starting or reversing. Air is admitted into the scavenging compartment under low pressure for starting the motor, but it is not necessary to bring the engine up to normal speed as it will "take hold" on the first half revolution. However, it is possible by means of an auxiliary lever to continue to operate on the scavenging piston as an air motor, thus making it possible to start the engine under load, and retain its starting power until it has reached its speed, as a steam engine.

Cold air is never admitted into the working cylinder, even the scavenging air being thoroughly heated before entering the combustion chamber; thus greatly doing away with the most prolific source of cracked cylinders, and pistons.

By the use of the scavenging motor for air starting purposes, it is possible to bring the motor from "Stone cold to full power in ten seconds" and to "Reverse from full ahead to full astern in five seconds." Mr. Kriemler reports that the Standard factory has been working night and day for several months to turn out the destillate engines now on order for spring delivery. Orders for 40 and 50 h. p. motors have been very numerous this season due to the excellent record in purse-seining and other fishing operations in Alaska, Puget Sound territory, and southern California waters.

That reliability will always retain for the gas engine a well entrenched position in the Pacific marine field is indicated by the fact that this concern recently shipped a big 175 h. p. marine engine for the Pacific American Fisheries, of Bellingham, Wash., a concern which was the pioneer in the marine oil engine field in the West.

SANTINO READY FOR TRIAL.

The motorship "Santino," recently launched by the Grays Harbor Shipbuilding company, will be given her trial trip Feb. 20, and the company expects to launch Hull No. 2 the same day.

ANOTHER MOTORSHIP FOR LIBBY, McNEILL & LIBBY.

The McEachern shipyard is about ready to start work on another motorship for Libby, McNeill & Libby. While details are still somewhat uncertain, it is understood that the vessel will be about 240 ft. long, some 20 ft. longer than the boat now under construction for this company. Figures are being taken for the engines, the contract for which will probably be let very shortly.

THE ASTORIA'S PRELIMINARY TRIAL.

The motor schooner "Astoria," recently completed at the McEachern yard, had her preliminary trial run Feb. 4, going from Astoria to Portland. She made an average speed of over 8 knots, which was much better than had been expected. The "Astoria" is 250 ft. long over all, with a length of keel of 220 ft., and is 23 ft. wide, 21 ft. moulded depth. She is rigged as a 4-masted bald-headed schooner, and powered with twin 240 b. h. p. 4-cylinder Skandia engines, running normally at 300 r. p. m. She behaved very well in every way on the trip, but will be given a more formal test before leaving, soon after the middle of February, for Port Pirie via Honolulu with about 1,650,000 ft. of lumber.

The McEachern yard will be ready to launch the "Margaret," a sister to the "Astoria," about Feb. 17; and another boat of similar dimensions and equipment about three weeks later.

THIS MONTH'S COVER.

The unusually clear photograph reproduced upon the cover of this issue of Motorship shows the launching of the auxiliary schooner "S. I. Allard," on January 16, by the St. Helens Shipbuilding company. This fine craft is 278 feet over all, 48 feet beam and 21 feet depth of hold, and will be powered with twin 320 b. h. p. Bolinder engines. The vessel is building to the order of the Chas. R. McCormick company, of San Francisco.

NEW ATLAS BUILDING COMPLETED.

The big new shop building of the Atlas-Imperial Engine company on the Oakland waterfront is now complete, and will be occupied during the coming month. The shop is 80 by 360 ft. in area, of heavy mill construction with corrugated iron exterior. The floor is well lighted by numerous windows along the sides, and the roof over the central part is raised, giving a double row of high clear-story windows above. The runway for the 40-ton crane, which will span the central 40-ft. of the building, is complete, with extensions over the railroads at both ends, and the crane will soon be set in place. Many tools, including some from the Imperial shop and some which the company was fortunate enough to pick up locally, are ready for installation; though it may be necessary to wait some time for equipment ordered from the East. Within another month or two, however, the new shop will be fairly complete and ready to start active work on the large Atlas Diesel type engines.

The gas engine department is extremely busy, and orders have been booked for delivery practically all through the year. Some 400 engines, including all sizes, are now in various stages of construction, and to keep up with orders it will be necessary to turn out over six engines a day from now through the spring.

The new Atlas-Imperial single-cylinder fishing boat engine is proving successful beyond expectations, and the first batch of about 100 is now coming through the shop, to be distributed to various parts of the Coast. Many new orders for this engine are coming in right along. This engine, having a bore of 6 in. and 7½ in. stroke, is giving a catalogue rating of 6 h. p., but in actual tests has proved a wonderfully strong engine for its size. Besides this it has several new and attractive features, and embodies a selection of the best ideas in design of both Atlas and Imperial engines, among the most important of which are the Imperial ignition system, which has gained great popularity among the fishermen, and the Atlas clutch and control devices.

One of the most important new features in this engine is the mounting of the levers operating fuel and exhaust valves on eccentric pivots, so that a very delicate adjustment of valve action may be obtained by simply moving two small levers turning these pivots. By thus slightly raising the fuel valve lever, the quantity of fuel admitted can be reduced to a minimum, yet kept uniform for each stroke; thus enabling the engine to run steadily, without danger of stopping, at exceptionally slow speed. By regulating the action of the exhaust valve, the pressure can be so relieved as to obtain an ease of starting that is, to speak conservatively, surprising.

WINTON ENGINES COMING.

The twin Winton engines for Hull No. 1 of the Peninsula Shipbuilding company, of Portland, which was launched in December, are now due to arrive and will be installed within the next month. The engines, which have each a capacity of 260 h. p. at 250 r. p. m., were completed and tested in January.

The Peninsula company has Hull No. 2 about ready to launch, and the engines, now nearing completion, will be on hand by the time the boat is ready for them.

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NEW MOTORSHIP AT McEACHERN YARD.

The McEachern-Standifer-Clarkson shipyard at Astoria laid the keel about two weeks ago for a full powered motorship. The dimensions will be, approximately, length over all, 280 ft.; beam, 45 ft.; draft, 24 ft. This order for the engine has yet to be placed. It is understood that the vessel is being built for the market.

SKANDIA-PACIFIC CO. COMPLETES FIRST ENGINES.

The first pair of Skandia engines built on the Pacific Coast was completed and turned over on the testing blocks at the new Skandia-Pacific shop in Oakland, Feb. 6. They are of 240 h. p. each, and are to be delivered for boats now building on the Columbia river. They will be kept on the blocks a couple of weeks before shipment.

NEW CONTRACTS FOR COLUMBIA WORKS.

The Columbia Engineering Works, of Portland, has just received contracts for the construction of four new auxiliary motor schooners, each of which will be propelled by a pair of twin Craig Diesel engines of 200 b. h. p. each. The engines will be of the 6-cylinder model, with cylinders 9½ by 12 in.

Three of the vessels will be freighters for the Manganese Mining company, of New York. The other, which will be of the same general type, was ordered by a Central American mining company.

McCORMICK MOTOR SCHOONERS.

W. R. Hewitt, marine superintendent of Chas. R. McCormack & Co., has been spending some time of late at the St. Helens, Ore., plant, looking after the completion of the company's new motor schooner "S. I. Allard," sister to the "City of Portland," which was launched about the middle of January. At this time the direction of the "Allard's" first voyage has not been determined.

The "City of Portland" is due at Honolulu with coal about Feb. 1, and will go from there in ballast to Columbia river.

W. R. GRACE INSTALLATIONS SOON.

G. M. Magruder, marine superintendent of W. R. Grace & Co., San Francisco, is now on Puget Sound in connection with the construction of the company's two new motorships, which will be launched within the next month or two, and will come to San Francisco for the installation of their Bolinger engines.

AN UNUSUAL UNION INSTALLATION.

The Union Gas Engine company has just received an order from a customer in the Philippine Islands for a pair of 50 b. h. p. marine engines, which, owing to certain peculiarities of the situation, are to be operated on alcohol, requiring some changes from the regular design, both as to the compression and the carburetor arrangement.

SHIPBUILDING MATERIAL SCARCE.

Complaint is becoming general among ship and engine builders, not only of extreme prices, but of an actual serious shortage of materials, which is greatly curtailing their output. The scarcity of plates for the construction of steel vessels has been a matter of common knowledge for some time, being a great factor in the present demand for wooden bottoms. Recently, however, wood of certain kinds required has been very hard to get, especially Australian ironbark, which is required for keels on Alaska salmon boats and the like. Shortage of this material has held back work on salmon boat contracts considerably. Prices of copper, brass and all galvanized materials are extreme.

Recently the engine manufacturers have been experienced trouble in obtaining shafting, and especially billets for forging large crank shafts, of the size required for some of the larger engines now being built. Not only is the price of such material extreme, but it is difficult to obtain for early delivery.

Other materials also are advancing; all steel products continue on the up-grade, while such raw materials as pig iron and coke have recently been held at unheard-of prices, owing to enormous foreign purchases..

SCHRECK WITH ST. LOUIS PLANT.

H. Schreck has been appointed chief engineer of the Diesel engine department of Fulton Iron Works, St. Louis.

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